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AMERICAN MACHINIST

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The Taylor Tandem Compound Automatic Engine.

We illustrate herewith a new tandem compound automatic high-speed engine which has recently been brought out by the Taylor Engine Co. It will be seen by referring to the sectional cut that the usual distance or tie piece between the cylinders and its attendant stuffing boxes has been omitted, and in its place a single cylinder head containing a set of metallic piston rod packing is used. It is claimed for this design that it economizes in floor space; that it dispenses with the necessity of keeping the two stuffing boxes usually found in the place in proper condition, and that by designing the engine in this manner it is more rigid and able to stand a greater amount of use and abuse without injury.

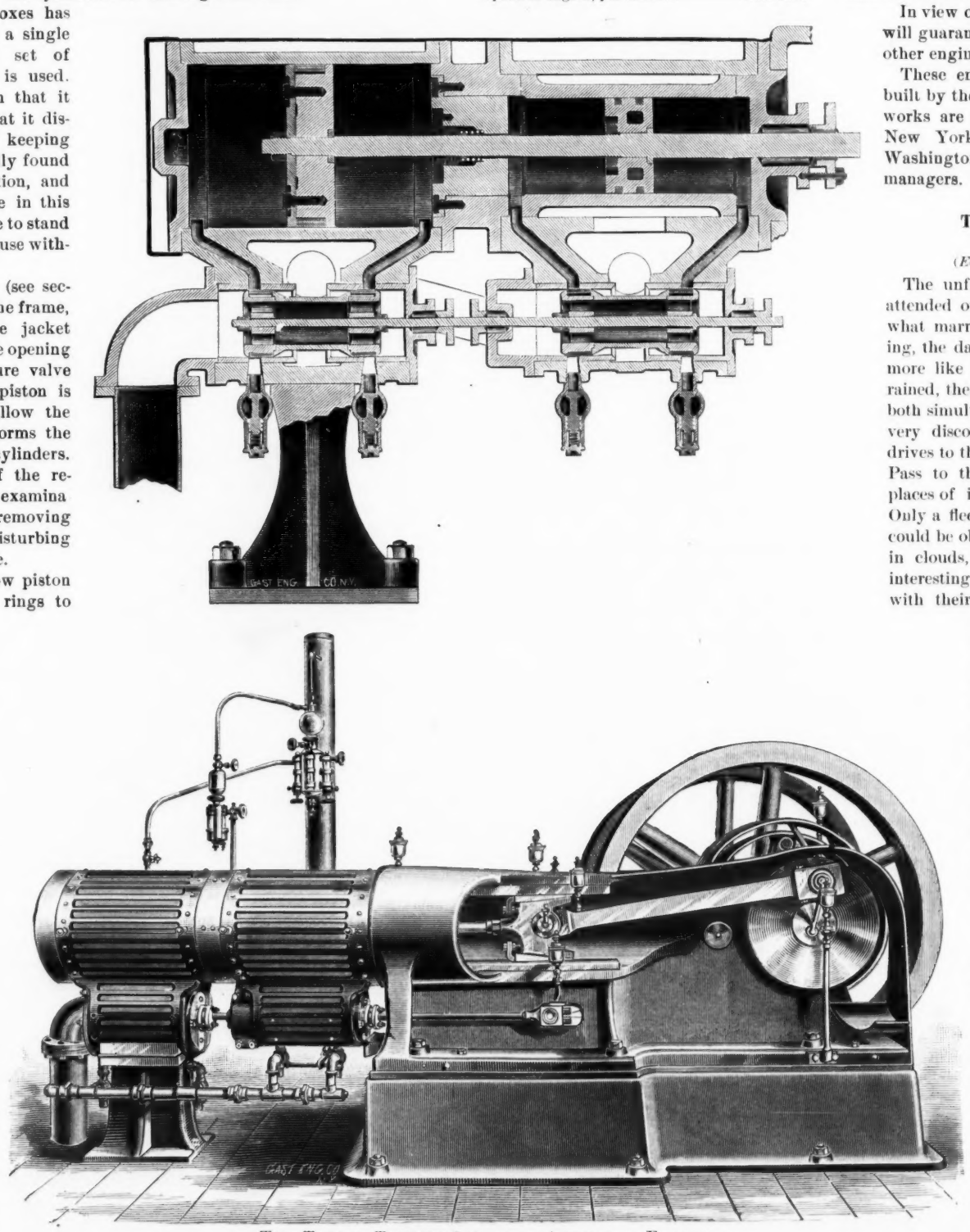
The high-pressure cylinder (see sectional view) is placed next to the frame, and is steam-jacketed. The jacket receives the steam through the opening in the top of the high-pressure valve chamber. The low-pressure piston is made detachable, so as to allow the removing of the head which forms the division wall between the two cylinders. This construction permits of the removal of both pistons for an examination of the cylinder without removing either of the cylinders or disturbing any other parts of the machine.

The valves are of the hollow piston type, fitted with adjustable rings to compensate for wear. Both valves are on one rod, can be adjusted independently, and are both connected through the rocker arms to the governor.

The support, shown under outer or low-pressure cylinder, is not bolted rigidly to it, but is gibbed to the cylinder in such a manner that, when the cylinders expand, they are free to slide on the top of the support.

The relief valves, shown attached to the lower side of steam chest, are so proportioned that, when the pressure in the cylinder exceeds that in the steam pipe, they will open automatically and relieve the cylinder of any undue strain.

The engine frame and other major details of the tandem compound are identical with those of the Taylor standard horizontal automatic engines, so well known.



THE TAYLOR TANDEM COMPOUND AUTOMATIC ENGINE.

A special feature in this compound engine is that any of the simple engines of the same make already in use can be compounded by simply substituting compound cylinders, thus avoiding the necessity of putting in new foundations and remodeling the plant.

The following test of one of these engines has been furnished us by the manufacturers:

"In an initial test of a 100 H. P. non-condensing tandem compound engine, with 9" high-pressure cylinder, 14½" low-pressure cylinder, and 13" stroke, made with friction brake, the following is the actual result:

"The coal used was of a rather inferior grade of Pennsylvania bituminous, and which had been found by actual test to be 20 per cent. inferior to coal generally used for making such tests.

"The weight of coal was ascertained by actual weight. 3,000 pounds were first placed in front of boiler, and when the test was finished the amount of coal left was carefully weighed, and the number of pounds remaining deducted from the above amount. This was done so that the fireman should not be restricted in the amount of coal burned, but should have the conditions practically the same as found in boiler rooms generally.

"The steam pressure carried was 100 pounds by gauge.

"The horse-power was determined from indicator cards, taken at regular intervals (every hour). The mean effective pressure of cards was determined from planimeter readings.

Duration of test	11 hours.
Speed of engine, per minute	265 revs.
Boiler pressure	100 lbs.
Diam. of high-pressure cylinder	9 inches.
Diam. of low-pressure cylinder	14½ inches.
Stroke	15 inches.
Average indicated horse-power	95
Total amount of coal consumed	2,134 lbs.
Coal consumed per hour	194 lbs.
Coal consumed per indicated horse-power per hour	2.04 lbs.

"Assuming the evaporative efficiency of the boiler to be 9 pounds of water for 1 pound of fuel burned, the water consumption per indicated horse-power per hour would be 18.36 pounds.

"If coal of the better quality had been used, it would have materially decreased the coal consumption; for, as before mentioned, the coal generally used for making these tests is 20 per cent. superior to that used in this instance.

In view of this test the manufacturers will guarantee an economy equal to any other engine of this type.

These engines, as before stated, are built by the Taylor Engine Co., whose works are at Chambersburg, Pa., and New York office Nos. 163 and 165 Washington street—Cooke & Co., managers.

To San Francisco.

(Editorial Correspondence.)

The unfavorable weather which had attended our trip thus far still somewhat marred the pleasure of sight-seeing, the day at Manitou Springs being more like March than May. First it rained, then it snowed, and then it did both simultaneously, in a way that was very discouraging. Nevertheless, the drives to the Garden of the Gods up Ute Pass to the Grand Cavern, and other places of interest, were much enjoyed. Only a fleeting glimpse of Pike's Peak could be obtained, as it was enshrouded in clouds, but the other scarcely less interesting mountains in the vicinity, with their thin covering of snow, and with light fleecy clouds partially concealing them, yet not rising to their tops, afforded many very beautiful views that were much enjoyed, as were also the wonders of the Garden. All these have been so often and so well described that there is no need that I should attempt it. No description can do justice to this country, and no one who has not seen it can form any adequate idea of its grandeur.

Here, for the first time, perhaps, the members of the party began to realize what was in store for them, and what a privilege it was to travel through such scenes under such comfortable and pleasant circumstances.

The railroad to the top of Pike's Peak was not yet open for the season, and consequently there could be no trip to the summit; some of the party, however, making a point of examining such parts of the road as were accessible.

Taking dinner at the Barker and the Cliff hotels, the party again took the train, and at 8 P. M. of the 8th left for Cañon City, having made up for the delay in leaving Chicago, and for the subsequent delays, by making the stop at Manitou one day instead of two. Pueblo, a most interesting city to the engineer, on account of its copper, lead, silver and gold smelters, iron and steel works,

was passed late in the evening, the train arriving at Cañon City, the entrance to the Royal Gorge, at 12 midnight, where it stood until the morning of the 9th, when the trip through the Royal Gorge was begun, the weather clearing by the time the gorge was fairly entered, so that its rocky cliffs were properly illumined.

Considerable disappointment was felt at finding no open or "observation cars," such as are usually attached to tourists' trains in passing through, but in lieu of this the train was stopped at the most interesting point—the Suspended Bridge, where vertical walls of rock rise above the track on either side, to nearly half a mile in height, and where the party alighted, gazed, took photographs with numberless varieties of hand cameras, and vied with each other in the search for adjectives to properly describe the solemn grandeur and sublime magnificence of the scene.

Walking across the bridge to the train, we again proceeded, and soon were in sight of the snow-covered, cloud-capped, yet sun-illumined Sangre de Cristo range, rising to the magnificent height of 14,000 feet.

Salida, Colorado, which lies at the base of these mountains, was reached at noon, and the afternoon was spent in a trip up Marshall Pass. Few trips by rail can be more interesting. The road is three-foot gauge and winds up the mountain sides, doubling and returning upon itself continually in order to keep the grade down to a uniform one of 215 feet to the mile, which, except for the first few miles out from Salida, is the uniform grade, the road being a succession of reverse curves, mostly of very short radius, down to 24 degrees. I had the pleasure of riding on this trip with the engineer, Mr. W. D. Yates, whose skill and intelligent handling of the engine and train I greatly admired. Though a narrow gauge engine, there was really nothing small about the machine except the gauge and the drivers, which latter had been originally 36″, but were then 34″. All the rest of the engine, the boiler, cylinders, etc., were as large as the ordinary standard gauge locomotive, as it may easily be imagined it must have been to pull four loaded coaches 26 miles up such a grade. For a good part of the way two portions of the track could be seen one above the other, and at one point three different portions could be seen ahead of the engine, each being far above the other, while by looking back we could frequently see stretches of track over which we had just passed that were so far below us as readily to produce dizziness while looking.

Steam, and plenty of it, was used all the way up, but coming down none except for the air-pump, the motion of the train being controlled—and kept very uniform too—by manipulating the brake valve.

Messrs. Hibbard, Hutton and Lewis served as ornaments for front end of the locomotive in descending, and when near the foot of the mountain, upon a tangent which permitted a somewhat accelerated speed, a calf, stepping onto the track in front of the locomotive and frisking along, made it seem for a moment as though men and calf might be rather more intimately mixed up than would have been desirable. The engineer, however, had his train under control, and assured himself that all was right before easing up on the brakes, remarking to me as he did so that he did not care to strike the calf, as it "might spoil that fellow's whiskers on the front end."

The man with the whiskers freely acknowledged afterwards that the inclination at that time was to shrink back into the smoke box.

At the top of the pass near the summit of Mount Ouray snowballing was indulged in, banks of snow ten feet high being found here, though in the valley below it was warm and pleasant. Here we were upon the ridge pole of the continent, and, looking one way, saw snow, which melting was to flow to the Pacific, while upon the other hand was that which was to help swell the Mississippi, and so reach the Gulf of Mexico and the Atlantic.

Returning to Salida, the train stood there until 12 midnight, some of the party attending a concert given by the Glee Club of the Colorado State University, which is located at Boulder. At the conclusion of the concert the members of the club were entertained in the composite car of the train, and in return rendered some songs and gave a serenade.

The early morning found us at the top of Tennessee Pass, again in the midst of snow, and by seven o'clock we had crossed the dividing line of the continent and were descending the Pacific slope. And the descent through the Eagle River and Grand River Cañons to Glenwood Springs was a scene of amazing grandeur. Every car step and platform upon the train was fully occupied, and as one splendid view after the other revealed itself, it was generally voted that if the Royal Gorge had been indescribably grand this was still more nobly grand, and many of the most steady-going and matter-of-fact engineers were observed to grow almost rapturously enthusiastic over it. The cliffs are of tremendous height, and are in many fantastic shapes, their bright red color in many places still further adding to their attractions. Numerous mining camps and paraphernalia are scattered among them, the ore being lowered to the track in most cases by wire ropes and small cars running on inclined railways.

Glenwood Springs was reached about 10.30 A. M., and there was a stop here of three and a half hours, to give opportunity for a walk about the place and the enjoyment of its famous hot spring baths. The elevation of he place is about 5,200 feet, though, judging by its surroundings, it would be thought to have what might be called a negative elevation. It is surrounded by high mountains, which at this time were covered with glistening snow, yet in a large swimming pool out doors, and filled with water which was a mixture of hot and cold from two contiguous springs, the resultant temperature being about 90°, a large portion of the party enjoyed a plunge and a swim, the bathing establishment of which this pool forms a part being one of the finest in the country—built at a cost of about $100,000, this outlay not representing mere size of the building, but elegance and luxury of a high order.

Leaving Glenwood Springs at 2 P. M., we proceeded, still on the Denver & Rio Grande R. R., through more picturesque country—another section of the Grand River Cañon—to Grand Junction, Colorado, where the road connects with the Rio Grande Western—a standard gauge road—and also with the Gunnison or narrow gauge division. Here at the station some of the excursionists were interested in seeing for the first time a narrow gauge Pullman sleeper—a thing which many did not know had an existence.

About 20 miles west of Grand Junction, the boundary line between Colorado and Utah—marked in white on the rock cliffs—was crossed, and we were in the land of the Latter Day Saints.

Passing through some very picturesque scenery in the early evening, the train was laid up at midnight until 5 A. M. of the 11th, when, soon after starting, the summit of the Wahsatch Range of Mountains was reached at Soldier Summit.

From Soldier Pass, the grade, descending to the west, for the first six miles is 217 feet to the mile, or slightly more than 4.1 per cent. This is said to be the heaviest grade on standard gauge, and with our heavy train it was interesting to note the smoothness and apparent ease with which the train was handled by the men, who, from their familiarity with air-brake matters, might be called expert pneumatic engineers.

A short distance west of the summit is a safety switch, which, as a safeguard against runaway trains, seems to be very efficient and is certainly ingenious. This switch always stands open at the approach of a descending train, and there is a man in charge of it, who never closes it until the train is stopped still by the engineer. Thus a positive assurance is given that the train is under control and can be stopped by the application of the air-brakes. If it should happen that the engineer for any reason could not stop the train before reaching the switch, the only result would be that he would run into a short spur rising abruptly into the mountain at such a grade that stopping would be easier than running ahead, and then whatever defects might exist in the brake apparatus could be remedied. The road crosses the mountains here at an elevation of 7,465 feet, and the total descent to Salt Lake City, where we arrived at 10 A. M., is about 3,200 feet.

Every American who has not seen Salt Lake City wants to see it. So much has been written of it, true and untrue, that one's curiosity is naturally aroused concerning it; and, immediately upon arrival, the party, divided into numerous sub-parties, started out in electric cars, carriages or on foot, as inclination prompted, to "do the town."

Naturally, the Mormon Tabernacle, with its mammoth arched roof, 250 by 150 feet and 90 feet high at the center, its wonderful acoustic properties and great organ; the uncompleted Temple; the Tithing Offices of the Mormon Church within their walled inclosure; the former residences of Brigham Young, where a portion of his family still resides—all this naturally attracted most attention, and the forenoon was spent in examining them, and in viewing and photographing the snow-capped mountains which almost surround the city.

After lunch in the dining car an excursion party was made up, consisting of about all the excursionists, for the Great Salt Lake, 18 miles away to the west. The trip was made over a narrow gauge division of the Union Pacific system, an incident of the trip being the bad heating of all four boxes of a truck on one of the coaches, the explanation given by the trainmen being the, to them, perfectly satisfactory one that the car was just out of the repair shops and the wheels and axles of that truck were new. The dimensions of these journals, as stenciled upon the truck frame, were $3\frac{3}{8}''$x$6\frac{1}{8}''$. Not a trainman knew anything of the weight of the car, but it is safe to say that the pressure on the journals could not have much exceeded 100 pounds per square inch, certainly not an excessive amount, or one which should make it difficult to secure good running new journals. All we could do, however, was to wonder why railroads do not more generally put a little more expense into car wheel journals, provide them with somewhat better oil, and save the steam required to heat and wear them to a bearing, as well as the expense of delays and repairs, while in this case the trainmen, under the direction of the trainmaster, who happened to be aboard, exchanged the disabled coach for one taken from a passing regular train, going towards the city.

Upon arrival at Garfield Beach, which is at the southern extremity of the lake, and is a popular summer resort for the people of Salt Lake City, the party alighted and spent an hour or so in gathering peculiar stones as mementoes, and in tasting the water to test its saline qualities. No shells were gathered, however, because there are none there.

The weather was bright and clear, and some very peculiar atmospheric effects were seen—islands which were actually fifteen miles away seeming to be only about two, while the more distant ones seemed to be raised above the line of the horizon, and suspended between the water and sky.

Some very desolate pen pictures of the Great Salt Lake have been drawn by writers who have visited it, and many of the party expected to see a lifeless, desolate and unhandsome body of water, surrounded by a flat and monotonous shore, upon which life could scarcely, if at all, be sustained. What we really saw was a beautiful sheet of water, gently ruffled by a northern breeze, and glistening in the sunlight shining upon it through an atmosphere of surpassing clearness.

The season was yet too early for the place to be used as a pleasure resort, but it was evident from what could be seen, and from what Mr. Wm. J. Silver, a resident member of the society, told us, that the place in summer was a most delightful one. The bath houses and pavilion here are probably not excelled upon the Atlantic coast, and certainly I have seen no such excellent bath houses anywhere, even at the most famous of the Atlantic coast resorts.

The water of the lake now contains a gallon of salt to six gallons of water; formerly, a gallon of salt was obtained from four gallons of water, the decrease of salt being attributed to the fact that the lake is rising slowly, and now covers a considerably greater area than formerly.

Shell rowing is indulged in here, but larger boats are not much used, because the season during which they can be used is short, and it is difficult to care for them during the winter, owing to the lack of a harbor. Some steamboats have been placed upon the lake, Mr. Silver having put the engines into the first and largest of these, but they did not pay, for the reasons already referred to, and are now dismantled. Fierce storms sometimes sweep over the lake, the waves running ten feet or more high.

Bathing here differs from all other bathing, in the fact that it is impossible for one to sink below the surface of the water, and, after coming out, it is absolutely necessary to wash off in fresh water, or great discomfort results from the superdermic deposit of salt. On this account, fresh water is on tap in all the dressing rooms and, strange to say, this is derived from wells which are driven under the salt water of the lake.

The special train was stopped during the day alongside of the roundhouse and shops of the Rio Grande Western road; and following my natural inclination, I embraced an opportunity to explore them, being very kindly welcomed by Mr. J. B. Dailey, the master mechanic, and Mr. C. M. Dunlap, the foreman of the machine shop. They are caring for 71 engines in service here, and have excellently cared for shops and equipment, the tools, shops and yards about them being models of neatness and cleanliness.

The tools are for the most part well selected, but, as is the case with most railroad shops, the equipment is not in every respect just what it should be, their best wheel lathe being a Sellers which was made for narrow gauge work and has been extended for broad gauge, but is nevertheless bragged on as being an excellent tool, while they bore car and truck wheels on a 50″ Niles boring and turning mill.

They had just started in use a vertical hydraulic press designed and built here, which they use for pressing in rod bushings, driving box brasses, etc., and for straightening bent rods, the available pressure being 100 tons. The machine consists essentially of a very heavy planed bed-plate from which rise two standards carrying a cross-bar, in the center of which is placed the cylinder and ram. All the valves are in a brass case which bolts to the side of the cylinder. The ram is counterbalanced by weights placed below the floor. I saw the machine in use, pressing in rod bushings, and it seemed very handy and efficient.

The boiler and engine rooms are especially noticeable for neatness, the boilers being new ones built in these shops and splendidly fitted up.

The most inefficient thing which I noticed here was a machine in the blacksmith shop used for grinding the treads of chilled car wheels. There is considerable of this work to do here, especially for foreign cars, the wheels of which frequently become flatted while on this road, and the cheapest way of making repairs is by grinding. The machine, however, is entirely too light, and is operated by feeding the 2″x$1\frac{1}{2}''$ corundum wheels into the face of the car wheels, first on a line with the flat until it is ground out, and then over the rest of the tread until completed, the spring of the rests, of which there is plenty, keeping the wheels in contact and at work after a fashion until the proper diameter is reached, assisted by an occasional jog of the cross-feed screw by the attendant.

As in all other railroad shops in this section, air-brakes receive a large share of attention, and at the end of the air-brake machin-

ist's bench there is erected a complete air-brake apparatus, including some sections of valves by which their operation may be observed by engineers, firemen, or others who may wish to study the mechanism.

Here the kindly offices of Frazer & Chalmers, who have a machinery depot in Salt Lake, still followed us, and in this instance were manifested by sending to the train a large lot of cut flowers with which, along with the wild prairie flowers previously gathered, the cars and the ladies were decorated and perfumed.

Leaving Salt Lake in the early evening, Ogden was soon reached, where watches were for the third time set back an hour, and morning found us among the sage brush of Nevada.

At Carlin about 10.30 A. M. of the 12th a stop was made to change engines and for a supply of water for the cars. Here, near the station, a number of Piute Indians were seen—bucks, squaws and one papoose, all gayly dressed and painted in all the colors of the rainbow. These Indians are superstitious with regard to being photographed, and can see and recognize a hand camera instantly and at any distance within photographing range. This fact, in connection with the further fact that the camera fiends on the train were determined not to let an opportunity escape them, caused much fun for the party, the c. f.'s being determined to "snap" the Indians, and the Piutes being equally determined not to be snapped, and covering their faces or hiding behind a post at every approach of a c. f., even though the latter adopted the subterfuge of carrying his black box concealed behind his back, and put on his most innocent and disinterested expression of countenance. With especial care was the papoose guarded against the evil spirit of the camera, and only by repeated bribes could a fleeting glimpse of its features be obtained.

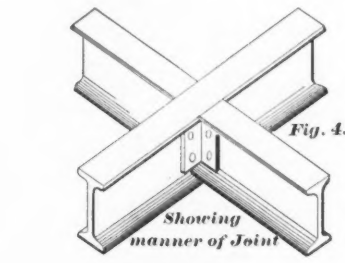
A very amusing incident of the stop was the precipitate and undignified retreat of Mr. F. M. Power before the furious onslaught of a squaw whom he had been attempting to photograph, who, suddenly turning upon him with stones, clubs, old tin pans or anything else that came handy, bombarded, routed and drove him in disorder upon his reserves, who were howling with delight upon the station platform.

F. J. M.

A curious phase of the labor question is reported from Paris, where an execution has been served upon the omnibus company by its men in the following circumstances. A court decision was rendered forbidding the company to keep its men employed for more than twelve hours a day, and in case the decree was not obeyed the penalty was fixed at 100 francs a day, to be paid to the syndicate of the men. The company ignored the decree, and the men continued to work for the statutory twelve hours, and for certain hours in addition. Thereupon the syndicate communicated with the company, but no notice was taken of the communication. The men continued to work during the forbidden hours, and the company continued to employ them. As the next step the syndicate claimed the penalty. But the company still pursued a course of masterly inactivity. It ignored the claim. Thereupon the syndicate became aggressive. A sheriff's man appeared at the bureau of the company, and asked for the full amount of the penalty from the day of the decision, and, the claim being ignored, seized tables, chairs, desks and office furniture. The defense of the company is that they have appealed against the decision. Meanwhile the men go on working overtime peacefully and contentedly as usual.—*Evening Post.*

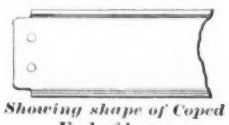
One at least—we believe two—bills are before Congress to grant substantially the same rights to other companies as were granted to the Inman Company in the instance of the steamships City of New York and City of Paris.

Out of 1,018 samples of wall paper the Massachusetts Board of Health found arsenic present in 389.



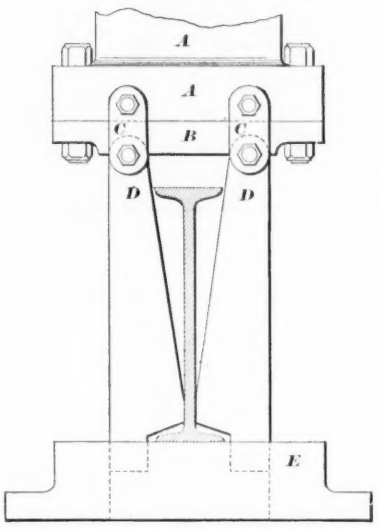
Showing manner of Joint

Fig. 4.



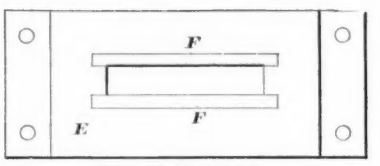
Showing shape of Coped End of beam

Fig. 3.



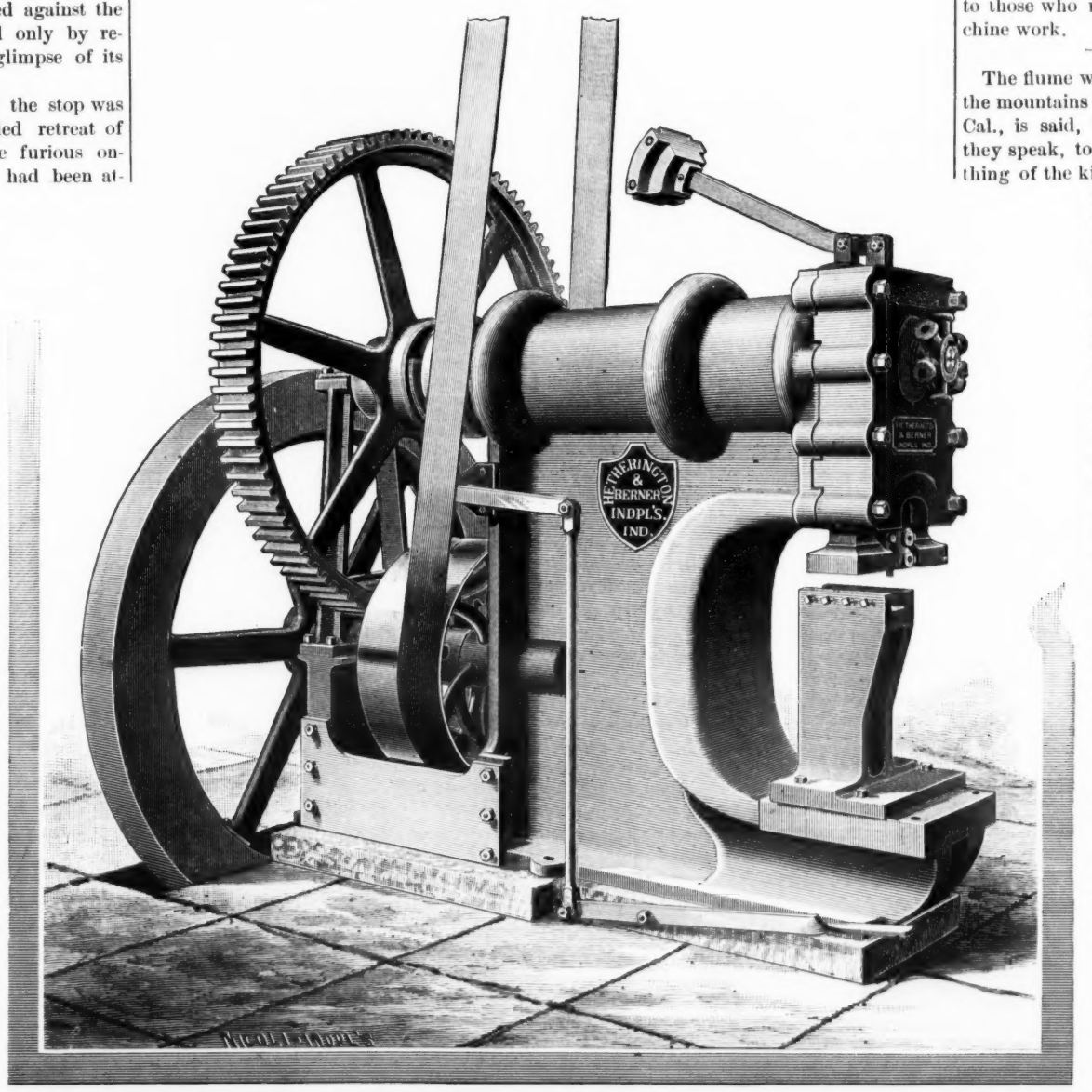
Front elevation of Coping Attachment Showing section of beam in position

Fig. 1.



Plan of Die-block

Fig. 2.



PRESS FOR ARCHITECTURAL, STRUCTURAL AND GENERAL PLATE WORK.

Press for Architectural, Structural and General Plate Work.

The punching press shown in the accompanying illustration, while suitable for almost all kinds of ordinary plate work, is so constructed that it is especially adapted to the needs of workers in architectural or structural iron work. The distance between the face of the plunger and the seat for the die blocks is sufficiently great to permit large-sized beams to be handled therein with ease, and also to enable the use of the various attachments needed in that class of work. The machine will receive beams varying in size from four to twenty inches, and may be arranged to punch two holes at once if desired. As shown in the illustration, the press is arranged to punch holes along one flange of an I beam.

For cutting coping connections in beams the attachment shown in the accompanying details is used, in which Fig. 1 is a front elevation. In this attachment a block *B* is secured in the usual manner to the plunger head; abutting this block *B* and fitted into proper receiving sockets are two cutting bars, *D D*, which are constructed of steel, and are linked to the head *A* by the detachable links *C C*, which serve to lift the cutter bars out after a cut has been made. The lower end of these cutter bars is received into a die *E*, the shearing edges of which are formed of two pieces of steel, *F F*. The cutter bars are of such length that their lower ends remain within the die at all times; only the portion that does the cutting rises sufficiently to leave the die, thus enabling the beam to be moved along lengthwise. The die block forms a guide for the cutters and holds them in position during the cut. If it be desired to cope one edge only of the beam, one of the cutter bars may be removed.

The whole machine is built in a most substantial manner, and is capable of the heaviest work of this class. The main casting of the press extends below the floor, and all parts are calculated to equally resist the strains put upon them. The weight of the press without attachments is from 14,000 to 15,000 pounds. The shaft is steel 7 inches in diameter. It is built by Messrs. Hetherington & Berner, of Indianapolis, Ind., architectural and structural iron workers and machine constructors, who furnish the finished machines, or the castings and drawings only to those who may wish to do their own machine work.

The flume which conveys the water from the mountains to the reservoir at San Diego, Cal., is said, by those who know whereof they speak, to be the largest and longest thing of the kind in the world. It is thirty-five miles long, and is composed almost wholly of redwood. In its course this monster flume crosses 315 streams and canons on trestles, the longest of which is 1,700 feet and 85 feet high. It is known as the Los Cochos trestle. The Sweetwater trestle, the second longest, is 1,200 feet long and 85 feet high. The timbers used in them were put together on the ground and raised to their present position by horse-power.

Besides its many trestles this flume passes through eight tunnels, the longest of these being 2,100 feet in length. The tunnels are each 6x6 feet in size with convex roofs.

Building a water-tight box thirty-five miles long over fathomless chasms and through the hearts of mountains is a gigantic undertaking which many believed could never be accomplished. The result has proved different.—*St. Louis Republic.*

According to recently published census figures it appears that two years ago the mercantile fleet of the United States consisted of 25,540 vessels, with a gross tonnage of 7,633,676 tons. These vessels employed 106,000 persons, to whom was paid as wages yearly $36,800,000.

A freight train consisting of thirty-five loaded cars has been hauled from Chicago to Philadelphia in seventy hours, the run being made with a single locomotive without change.

Sixteen-inch Gun Lathe.

The sixteen-inch gun lathe, of which we give illustrations, built for the U. S. Government, has recently been set up in the ordnance department (Washington Navy Yard) by its designers and builders, Wm. Sellers & Co., Incorporated, Philadelphia, Pa. It is the largest lathe built in this country, and probably the largest built in any country. It is to be used for turning and boring the sixteen-inch breech-loading rifle guns, which are expected to be in the course of construction at an early date. This lathe is designed, especially, to permit the use of a broad, flat turning tool, fed at right angles to the axis of the gun, and consequently is provided with a very powerful feeding gear, and a quick traverse for moving the tool carriages and the slide rests.

The main bed is 73 feet 10¾ inches long, 9 feet wide by 2 feet deep; this part is made in two sections bolted and keyed together. It has four ways, two of which carry the tool carriages on one side, and the other two serve to hold the steady rests and tail-stock on the other side. The middle ways are formed in one section of metal, with a diagonal slot between them, as shown in Figs. 4 and 5, for clamping bolts to hold the steady rests and tail-stock; this slot terminates at the end of the main bed. The narrower part or boring bed supports a boring bench; it is 54 feet 5 inches long, 5 feet 2 inches wide by 2 feet deep; it is made in two sections, bolted and keyed together, and the whole bolted to the main bed. The main casting of the head-stock spreads over the whole width of the main bed, as shown in Fig. 3, and is rigidly continuous between the bearings of the main spindle, thus making it enormously strong for strains in all directions.

The main spindle, back gear spindle, and the cone spindle in the head-stock are of forged steel, and run in solid bronze bushings carefully fitted to the head-stock and caps, and firmly clamped by the latter. The front bearing of the main spindle is 20 inches diameter, 32 inches long; its rear bearing is 14 inches diameter, 24 inches long; distance between centers of bearing, 6 feet 9 inches. The face-plate fits tight on the nose of this spindle, and is further secured to a collar on the same by large tight-fitting steel bolts.

The front bearing of the cone spindle is 9 inches diameter, 19 inches long; the rear bearing, 6¾ inches diameter, 14 inches long. The cone pinion, of tough bronze, has a projecting hub, with a flanged collar, which is connected with the cone by a breaking pin. The cone is carried by a sleeve on its spindle. The cone has seven steps for an 8-inch double-belt, ranging from 20 for the smallest diameter to 60 inches for the largest.

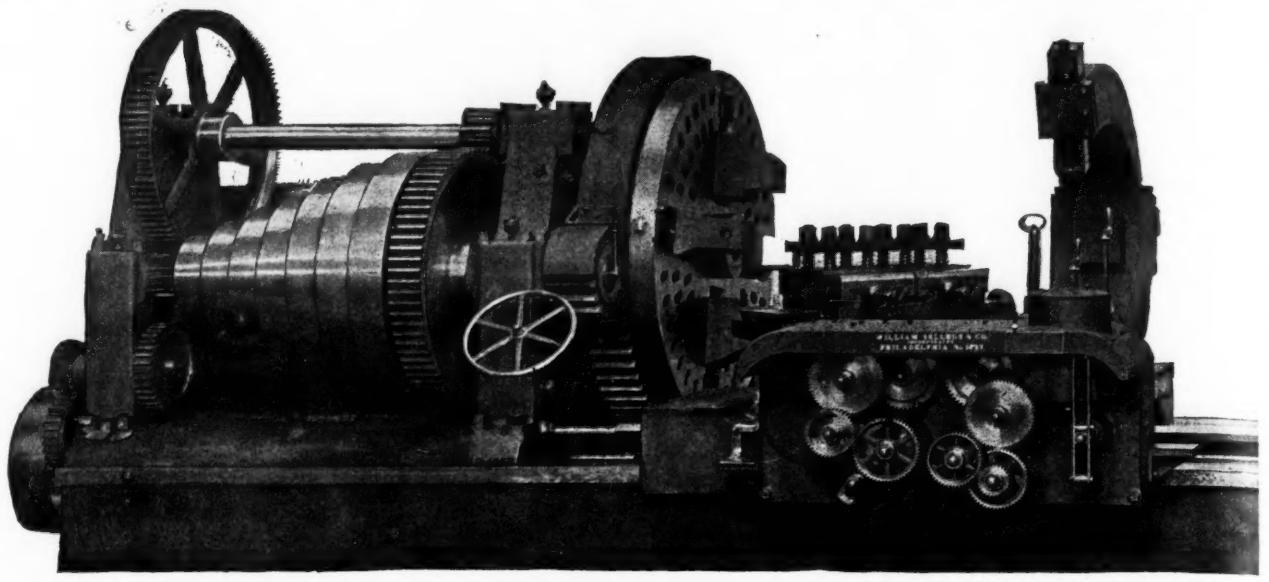
The face-plate pinion has fifteen teeth, 4 inches pitch, and 10½ inches face, and is keyed to its shaft. The back gear shaft is above and behind the cone; it has a front bearing 6 inches diameter, 19 inches long, and a rear bearing 6 inches diameter and 14 inches long.

The cast-steel face-plate is provided with four adjustable jaws, and a gear wheel having 75 teeth, 4 inches pitch and 10½ inches face.

The ways for the jaws serve as braces between the exterior and interior rings of the face-plate, making it exceptionally strong. Height of center over surfaces of bed, 4 feet.

By running the countershaft at 180 and at 216 revolutions per minute respectively, 14 speeds of the face-plate are obtained, ranging practically by an exact geometrical progression from 0.4 to 4.3 revolutions per minute, with a safe cutting pressure of 140,000 pounds on a 50 inch diameter, and on the lowest speed.

The tool carriage consists of a saddle and a cross-slide, provided with a slide rest, adjustable about a vertical axis, which carries two tool rests with independent cross adjustment. The saddle slides directly on the two front ways of the main bed, and is held down to both of them by inside shoes, and it is guided for a length of 9 feet by the front way, on which the thrust of the cut is taken. The axis of the adjustable slide rest is one foot out of center toward the head-stock end, to bring the tool slides as close as possible to the face-plate. The saddle is fed and also run rapidly along the bed by a long nut revolving on a 6-inch steel screw, fixed at one end in the



SIXTEEN-INCH GUN LATHE.

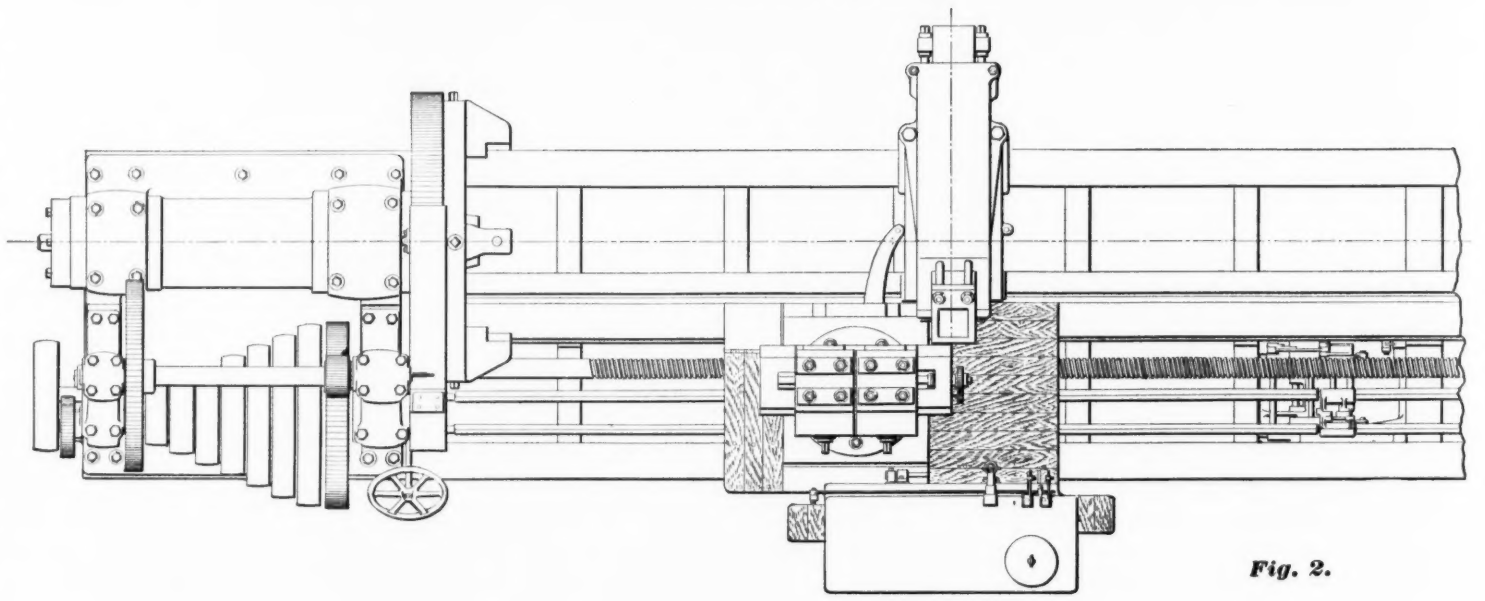


Fig. 2.

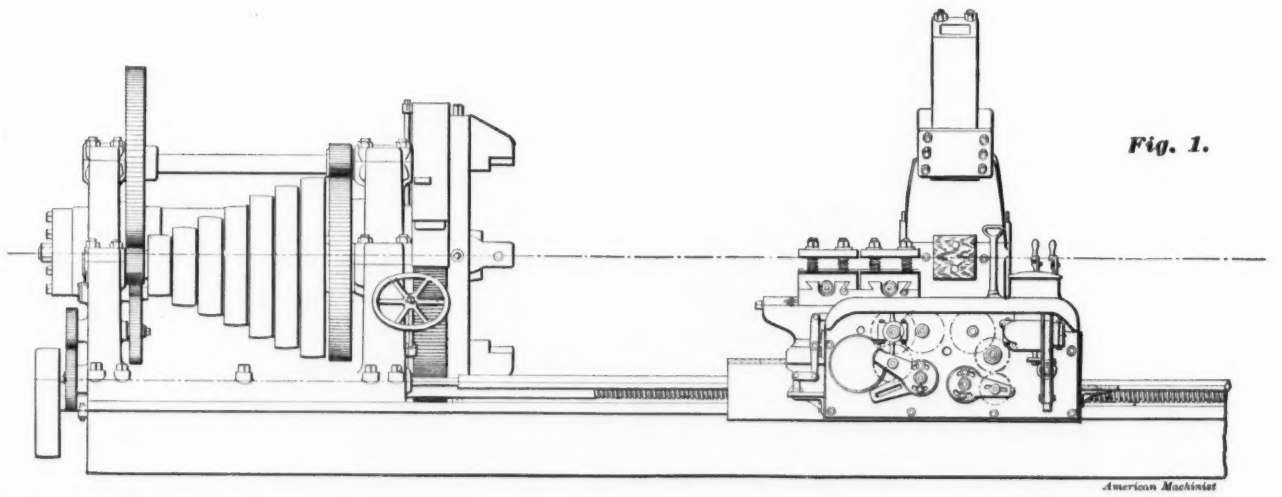


Fig. 1.

Fig. 3.

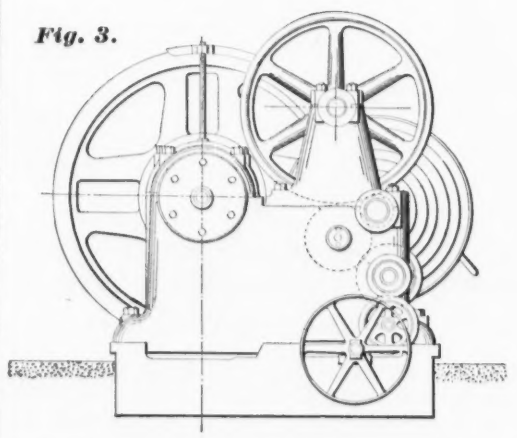
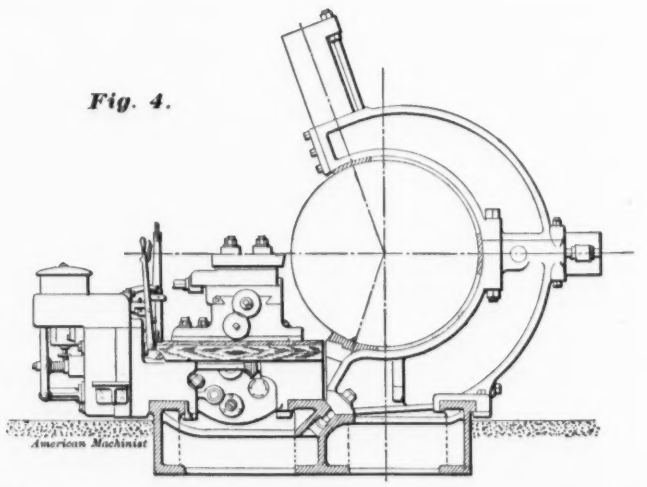


Fig. 4.

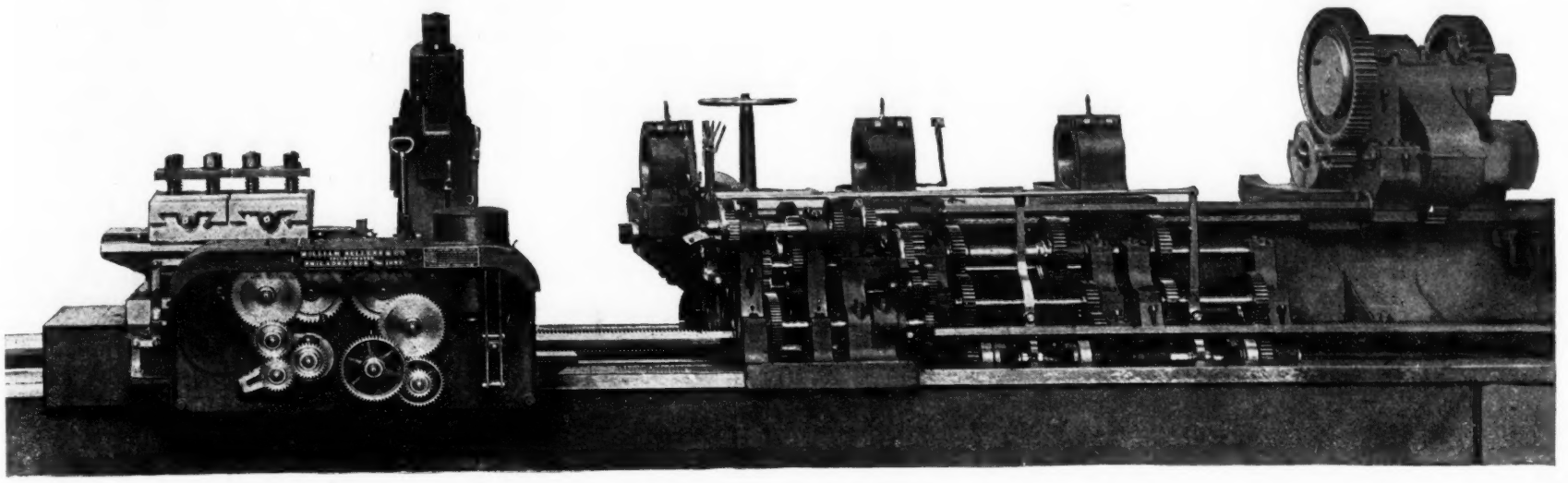


head-stock, and at the other in the far end of the main bed. This nut receives its feed motion from a square feed shaft along the bed, driven from constant gears on the head-stock, and its quick traverse from a similar shaft driven at a constant speed by a pulley at head-stock end of the bed, which gives a traverse controlled by hand of 20 feet per minute to the tool carriage. By this construction, the quick traverse on one carriage can be instantly operated in either direction as soon as the feeding clutch is disengaged, and without disturbing the other carriage, whether this be screw cutting or turning. As two carriages are provided with this lathe, their individual traverse is necessarily reduced in consequence, but it is sufficient either for work at the face-plate in one direction, or for screw cutting and facing in the other. Ample clearance is provided at the foot of the lathe, between the muzzle of the longest gun and the tool-post. Swing over carriage, 70 inches in diameter.

All changes for feeds and screw cutting are made on the saddle, thus making the two tool carriages entirely independent of each other in all their movements. The cross-slide is fed by a 3 inch steel screw which also receives its motion from the square steel shaft in the bed.

By feeding the cross-slide and the saddle simultaneously and changing their relative amounts, the following tapers may be obtained by change of gears furnished with the lathe.

(1 or 10) in 20, 24, 28, 30, 34, 35, 36, 38, 40, 45, 48, 50, 54, 55, 58, 60, 64, 70, 75, 80, and (1 or 10) in twice the above values.



SIXTEEN-INCH GUN LATHE.

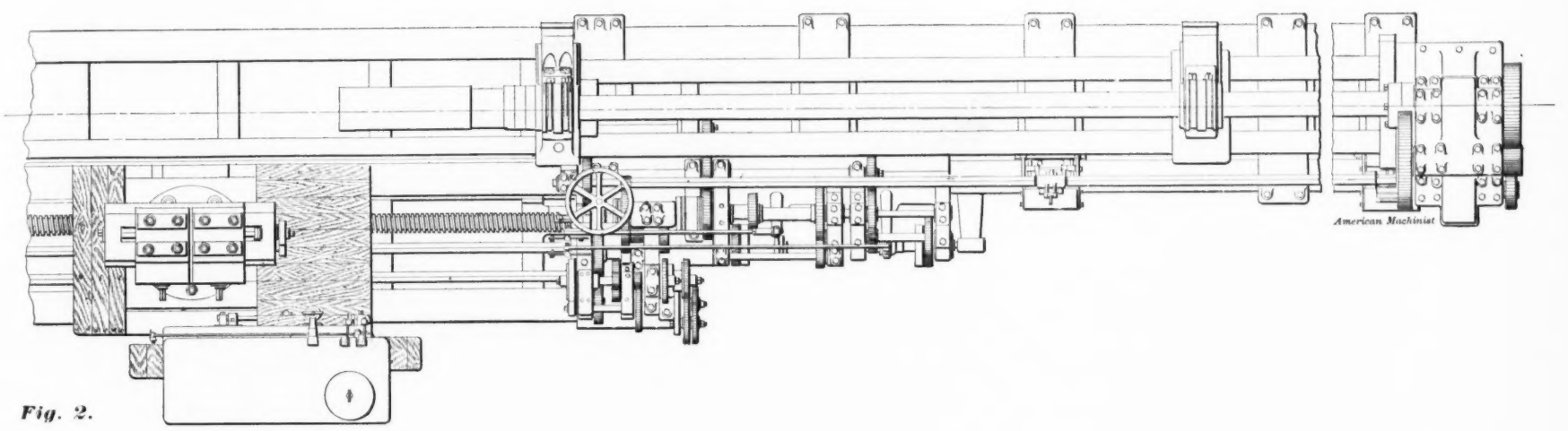


Fig. 2.

Fig. 1.

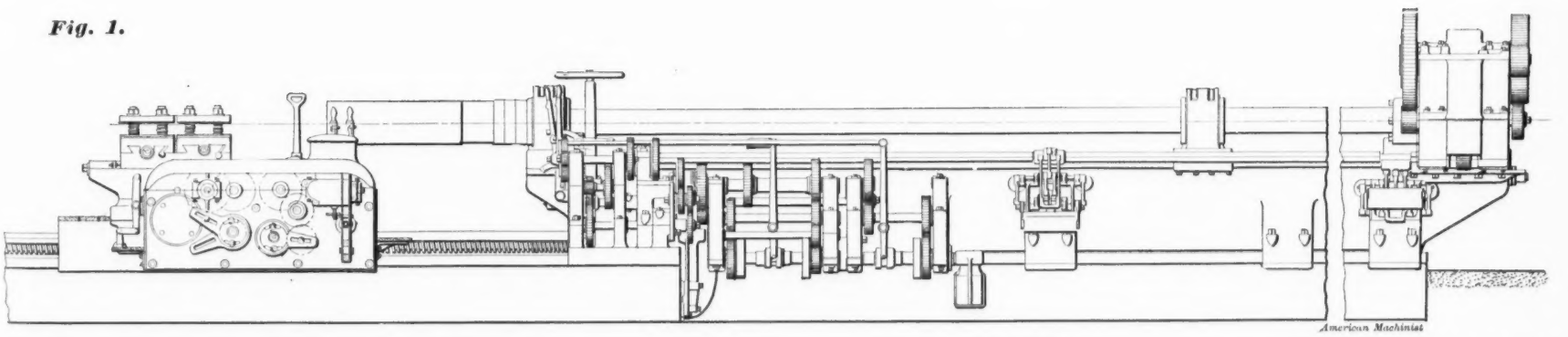
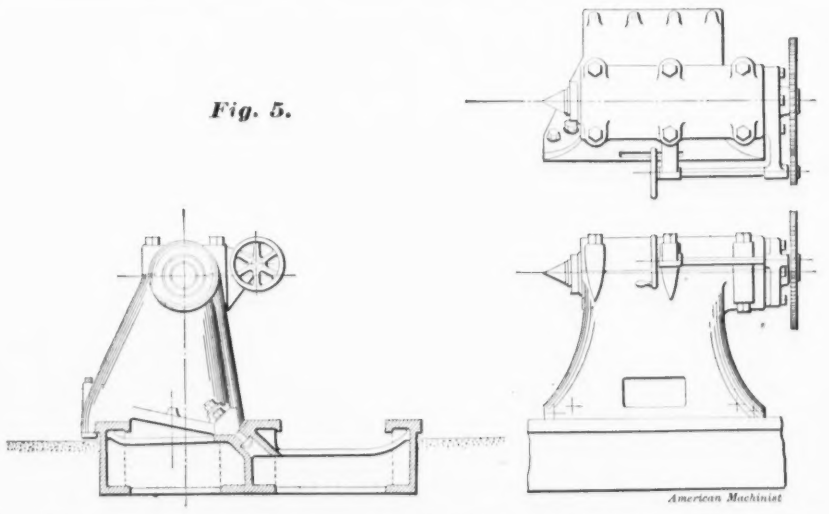


Fig. 5.



The following longitudinal feeds of saddle may be obtained: From .02 inch to .1 inch, varying by .01 inch; from .1 inch to 1 inch, varying by .1 inch, and from 1 inch to 3 inches, varying by .25 inch; also .75 inch, .85 inch, .95 inch and 1.35 inches.

For screw cutting, the carriage is intended to be run back by a quick traverse after each cut, and an indicator is provided to show the proper time for throwing the screw cutting clutch into gear; this indicator can also be used for spacing the threads when cutting screws of more than one thread. The indicator can be used to advantage for pitches varying by hundredths of an inch, and thus provide for all practical requirements. For turning, all the feeding movements of all the slide rests are also operated by the quick traverse, so that, whatever feed is being used, the tool can be run back to its starting point by a quick traverse, operating through a friction clutch controlled by the operator.

The rapid traverse lever and the longitudinal feed levers are so interlocked that they cannot be thrown in simultaneously.

The safe feeding pressure for longitudinal traverse is estimated at 82,300 pounds for a feed of 3 inches or less. The cross-feed varies from 33,000 pounds for 3-inch pitch to 100,000 pounds for fine feeds. The feed for top slide varies from 25,000 pounds for 3-inch pitch to 35,000 pounds for 2-inch pitch or less. All the permanent feed gears are large, and carried on stiff shafts between ample bearings, the change gears only are overhung and all arranged to distribute the pressures so as to insure durability and easy running. The two square shafts, and the long feed screw in the bed, are supported at proper intervals by tumbler bearings provided with caps, and all are automatically opened and closed by the tool carriage as it passes by.

Four steady rests are provided to take in respectively 61 inches, 54 inches, 40 and 27

inches. The frame consists, as shown in Fig. 4, of a lower half bolted by the diagonal slot to the bed and clamped to the back of the bed by a shoe. This part of the frame carries the lower jaw and embraces the horizontal adjustable jaw back of the lathe center. The upper half of the frame fits over this jaw and is bolted securely to the lower half by heavy steel bolts. It carries at its extremity another adjustable jaw at an angle of 20 degrees to the perpendicular. The lower jaw is adjustable at the same angle, and thus the jaws of the steady rest embrace an arc of 220 degrees plus the length of one block in degrees.

The traverse of the steady rests is accomplished by coupling to a bar on the tool carriage, which serves either to push or pull them, as required. The same bar is used also to move the tail-stock on the turning lathes. When not in use, this bar is unshipped, to permit the tool carriage to pass the rests.

The tail-stock shown in Fig. 5 rests upon two ways at back of bed, and is bolted to the diagonal slot by six 2¼-inch steel bolts, with long T-shaped heads. It is provided with a steel spindle, 14 inches diameter, and a steel center 8 inches diameter. The spindle is conveniently adjustable from the front end of tail-stock, and is capable of being clamped firmly in its bearing. (By removing the spindle and thrust block, the tail-stock may be used, if desired, as a boring bar support.) The tail-stock is entirely clear of the ways upon which the carriage moves, so that the carriage may be run entirely past it, if desired. This construction enables the tail-stock to have its base project forward under the center, avoiding all oversetting tendency, and enables the tool carriage to face off the end of the gun with the minimum projection of the tail-stock spindle.

The boring bench shown in Figs. 1 and 2 is made in two sections, and is adjustable on the bed by power acting through a revolving nut on the 6-inch steel screw in the main bed. It is clamped to the outside of its bed by shoes. All the mechanism required for moving the boring bench, for boring feeds, and for quick traverse of boring bar, is bolted to the front side of boring bench, at the end nearest the face-plate, its framework being also supported by the two front shears of the main bed, and sliding upon them when the bench is moved. This mechanism is driven by the feed and quick traverse shafts in the main bed, so that no motive power, shafting or counters are required, except at the head of the lathe.

The boring bar is supported by a capped and bushed fixed rest at the front end of bench, by a slide in which it is held and centered at the rear end, and by two intermediate supports traveling with the slide at proportional rates of speed.

The rear end slide carries a gear wheel 30 inches in diameter, whose axis coincides with that of the boring bar; this gear wheel has 30 teeth and is driven through a friction clutch from the square shaft for quick traverse in the main bed.

The boring bar is attached to this gear wheel, and change gears are provided, so that the boring bar can be rotated in the opposite direction to that of the gun and at any speed that may be desired, whereby the rate of boring is rendered independent of that of turning.

The slide or driving head is provided with a fixed nut on a five-inch feed screw in the boring bench. This screw receives both slow motion for feed and quick motion for bar traverse through a short gear shaft connecting it with the proper train of gears on the side of the boring bench.

All feeds provided in the tool carriage are given on the boring bench, and in addition, by means of an extra back gear, each of these feeds can be divided by ten. In this way a much wider range of feeds is given for boring and screw cutting.

The change gears are the same for both tool carriage and boring bench, any given arrangement of them producing the same feed in either case, with same back gear.

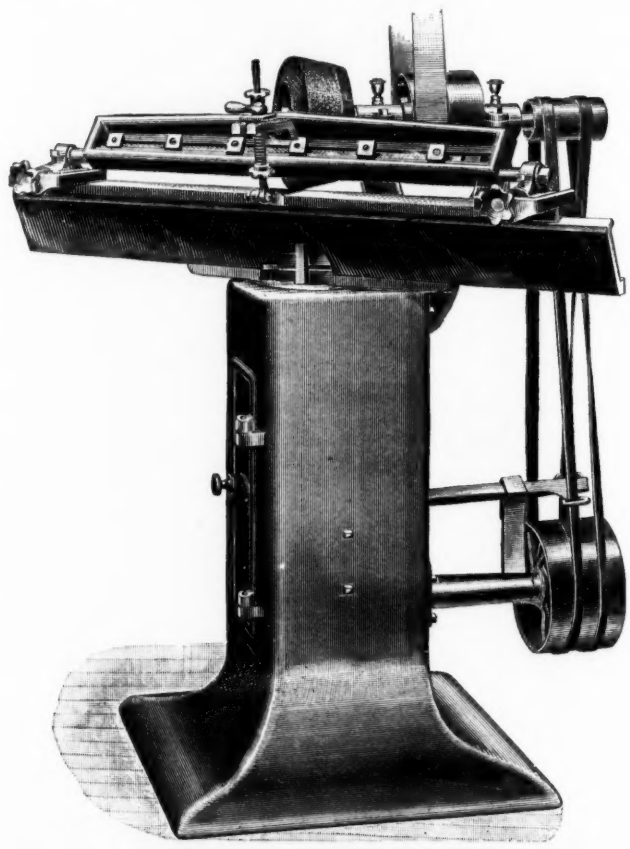
The boring bar carriers are provided with side extensions upon which the bar can be rolled out of the axis of the lathe for the more convenient examinations of the bores of the guns.

Three 14-inch gun lathes without the boring arrangement are now in the course of construction in the shops of William Sellers & Co., Incorporated, and three 14-inch gun lathes with the boring arrangement are in the course of construction in the shops of Bement, Miles & Co., Philadelphia, this latter firm having already delivered and erected one such lathe in the Washington Navy Yard. All these lathes are being built from the designs of Wm. Sellers & Co., Incorporated.

On account of the size of the illustration, we were compelled to let the longitudinal views extend across two pages, but the illustrations are so arranged that by folding one of the pages they can be made continuous.

A New Automatic Knife Grinder.

We illustrate herewith a new automatic machine for grinding long knives such as are used on wood planers, paper cutters, etc. It belongs to that class of knife grinders which carry a cup-shaped emery wheel, but there are several new features about it, the most important, perhaps, being its adjustability for flat or concave grinding.



A NEW AUTOMATIC KNIFE GRINDER.

The slide or bed, by slacking one bolt, can be set at different angles before the wheel, which allows the knife to be ground a flat bevel or any desired concave. The emery wheel is made flat on its cup face, excepting the outer corner, which is rounded off. If the bed be set at a right angle to the emery wheel spindle, the knife will traverse back and forth against the flat face of wheel, and the knife will be ground a flat bevel; if, however, the bed be set at any other angle, the round edge of the wheel will do the grinding and a concave bevel be the result. This feature will be appreciated by those who prefer a flat stout edge for rough work, and a thin concave edge for fine work.

In the illustration the bed is shown set at the full limit for concave grinding, equal to the arc of a 16" circle.

The shifting of the belts that drive the bed back and forth is accomplished by a very simple arrangement of two belt cranks, one above and one below, connected by a rod with ball joints at either end. The lower crank is connected to the shifting rod, and the upper one extends up through the top of the base and is acted upon by adjustable dogs, when the bed has traveled the required distance.

The arrangement is such that the bed can be adjusted at different angles without affecting the belt-shifting operation; in fact, the bed can be swung while the machine is in motion.

The saddle that carries the knife-holding bar is laid on the bed without gibs, as the bed is sufficiently long to allow of necessary travel without danger of the saddle falling off.

Altogether this machine seems to be simple and effective. It is made by Saml. C. Rogers & Co., Buffalo, N. Y.

LETTERS FROM PRACTICAL MEN.

Grinding Lawn Mowers.

Editor American Machinist:

W. H. can grind his machine by taking off the driving wheels and placing the machine between the centers of a speed lathe, running a fair speed and running machine same way as when in use. By putting oil and emery on as it revolves, and adjusting the straight blade, he will make a satisfactory job in a short time. CHAS. LEISSING.

Editor American Machinist:

In answer to Question 185, if W. H. will put a crank or handle on the driving wheel of his lawn mower and block the ratchet so he can turn the machine backwards, he can do a good job of grinding by using emery and oil on the knives and setting up the lower knife by the adjusting screws as the knives grind down.

Turn backward while grinding, and test by cutting wet tissue paper. The blades should cut evenly the whole length.

W. H. SHIPLER.

To Convey Molding Sand.

Editor American Machinist:

I have read J. A. L.'s inquiry about conveying molding sand from machines to hopper for re-use, in issue of May 5, and as I happen to be working near a coal storage plant I thought that something after the plan for conveying coal might suit his purpose. It will be necessary for me to explain the general plan of operation, so that he may better judge if a part may not be applied to his case.

First, the coal is dumped from the cars into a hole where a sprocket wheel works, around which an endless chain with steel scrapers or drags works. On top of a derrick about seventy feet high another wheel similar to the above is fixed, which also engages the chain. This system, being driven by suitable gearing, elevates the coal, leaving it in a conical pile in the yard. When it is required to use from this pile for coaling the engines, another endless chain with scrapers running horizonally close to the ground, the scrapers projecting at right angles to chain, drags the coal from the foot of the pile to another pit, where other chain scrapers drag it up on steel plates inclined to the hopper, where, by raising slide doors, just enough is allowed to escape to fill a locomotive tank, the arrangement being somewhat after the manner a charge of shot is taken from a common pouch.

Should this suit J. A. L., if he will write to me (my address may be obtained at your office), I shall be pleased to send him a sketch and any other particulars concerning it that he may desire. WM. NEWTON.

Are American Engineers and Builders Boastful?

Editor American Machinist:

To continue this subject, I suppose most of the readers of the AMERICAN MACHINIST have seen Mr. John Bourne's "Catechism of the Steam Engine," published in 1864, also his Hand-book of the Steam Engine of 1865, and his largest work, "A Treatise of the Steam Engine," in 1868.

The catechism speaks of two American automatic cut-off steam engines, viz., the George H. Corliss and the William Wright, or Woodruff & Beach engines.

He says: "Of this class of engines, those manufactured by the Corliss Steam Engine Company, of Providence, R. I., are perhaps the widest known, not only for their extensive introduction, but also from having by long and successful litigation established the claims of the patentee, Mr. Geo. H. Corliss."

He then describes the well-known compound eccentric and concentric cam, invented in 1852 and 1853 by William Wright (then of Hartford, Conn.), now of Newburgh, N. Y., and used by Messrs. Woodruff & Beach, of Hartford, Conn., for many years.

After describing and illustrating these two valve motions, Mr. Bourne says: "It is unnecessary to insist on the great economy attained by using steam with a well-regulated cut off, for practical men know now that the essential points of excellence in the steam engine are a good boiler which generates the greatest quantity of steam for the least consumption of fuel; and secondly, a reliable cut off which uses the steam to the best advantage by admitting the proper quantity for the work required."

About fifteen years ago I asked an English engine builder who was visiting this country if he knew what Mr. Bourne meant by the closing clause in the above quotation. This builder at once answered that Mr. Bourne, and nearly all of the builders and engineers in Europe, placed very little, if *any*, value on any releasing cut-off motion controlled by the governor. He said the gain or saving in fuel was more than counterbalanced by repairs, and that our engines were speeded *much* too high for economy, as 400 feet piston speed was the limit.

I have Mr. D. K. Clark's latest extensive work, entitled "The Steam Engine," and am utterly amazed at the extremely meager amount of space allotted to American automatic steam engines. In vol. 3, page 40, Mr. Clark very strongly intimates that Mr. Watt invented the whole Corliss valve gear, but he does not furnish us with the date of Mr. Watt's patent, nor does he mention any particular engine in Mr. Watt's time that was fitted with this gear. Mr. Clark also says that Mr. Sickles perfected the liberating valve gear and dash-pot in 1841. Mr. Frederick Sickles, of New York, applied a liberating motion adjustable by *hand only*, and connected to a water or oil dash-pot about the years 1842 and 1843. The motion at that time was not perfected, and it was not perfected until about the years 1851 to 1855. Mr. Corliss was working on his trip and dash-pot motion in 1847, and perfected it in most of the details in 1848 and 1849, and the first model ever made of the motion was automatically regulated by the *direct* action of the governor.

Mr. Sickles was interested in marine engines to a large extent, and he was not looking for the automatic action of a governor. Mr. Sickles' dash-pot was at first a simple water or oil cylinder, but later on it was developed into an elaborate but well-

made appliance. This dash-pot seated its plunger on oil or water that was passed by the falling of the plunger into the receiver, where it was again ready for use.

Mr. Corliss had not used his air dash-pot long before he found that he could dispense with weights and springs, and rely on the partial vacuum formed in the pot to almost instantly close the valves, and also to arrest the fall of the valve just beyond the closing point.

Mr. Clark says that all of the best engine builders in England close their Corliss engine valves by coil springs (which he illustrates) placed in the dash-pots and above the plungers; so, as I understand it, they have not yet learned how to build a Corliss engine in England.

Do we boast more than our English friends? I will in answer here append a few words gleaned from an English publication, the *Mechanics' Magazine*, London, covering dates from July to December, 1851. This letter, dated at 104 Wardour street, London, October, 1851, runs as follows:

"SIR—A great deal has been said lately respecting the claims of Mr. Colt to the invention of the revolving pistol; it will perhaps throw a further light upon the subject when we state that, in the year 1822, between the months of February and September, we made the barrels of 200 muskets and 200 pistols upon precisely the same principle as those exhibited by Mr. Colt, for a gentleman named Collier, of Fountain Court Strand, upon which occasion the lubricating fluid now so universally used by engineers, viz., soap and water, was first introduced by us; one of these very barrels was, we are informed, exhibited in the English firearm department of the exhibition. We have one also in our possession, and can easily prove our assertion by our books, which we shall be happy to show to any gentleman upon application, so that the matter may be set at rest as to Mr. Colt being the original inventor.

We are, sir, your obedient servants,
JOHN EVANS & SONS,
London."

Of course this cooked the goose for Col. Samuel Colt; but he continued to make pistols in England as well as America all the same.

One more letter from the same magazine—this time from Mr. Thomas Prosser, of New York, Oct. 22, 1851.

"SIR—I have observed in a scientific journal of this month, a notice of the Swedish steamer Berzelius, in which the editor gravely observes: 'The boilers are tubular, and the tubes are fitted in the tube plates in rather a peculiar way. In addition to the ends being upset into a countersink, the tubes are slightly enlarged just behind the tube plate by a suitable tool after they have been fixed in the ordinary way.' Now, sir, with the exception of the 'ordinary way,' tubes are fitted in the tube plates in no other than this 'peculiar way' in America, nor have they been for many years past. I obtained a patent for the tool, by means of which the operation is performed at once, that is to say, the end of the tube is expanded on either side of the tube plate at one operation. This tool is now in universal use in the United States, and with it, and under my own immediate inspection, all the tubes of the boilers in Collins' rather fast line of steamers were fixed. The number of these tools which I have sold is enormous; and yet, to my astonishment, I find that tubes are still being put in here in the old tinkering manner, which no engineer in the United States would now tolerate for one moment.

"I would observe that every tube being a stay-bar, no others are used, whatever the pressure of the steam may be, and I have known of it being rather high out West.

I am respectfully,
THOMAS PROSSER,
Of New York."

The trouble is, as all practical engineers and builders well know, that persons "booked" as engineers who travel the most in Europe are to a man howling Anglo maniacs of the first water, and lack courage to defend the inventive and engineering genius of their own country.

Did Mr. Bourne, in his great work of 1868, give his readers the benefits of the many original American inventions in steam engineering? Not at all; but instead, he illustrated and described engines of *English* make that had been discarded in America more than a dozen years.

Does Mr. D. K. Clark give his patrons the benefit of the *best* American inventions in steam engineering projected during the past *ten* years? I should say not. There are at least ten first-class engines and five new boilers invented here that do not get even a passing mention, and some of the special tools designed for the construction of these engines and boilers have never been surpassed in strength and efficiency in any country on the globe. OBSERVER.

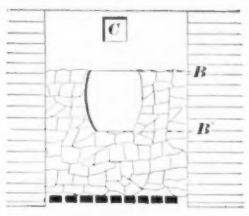


Fig. 11.

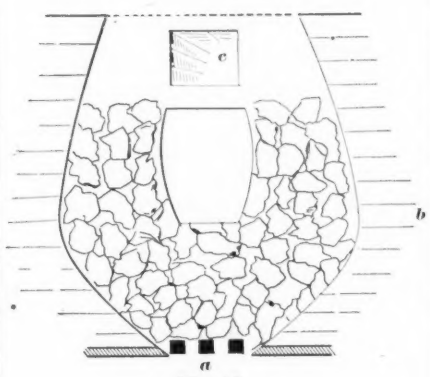


Fig. 12.
BRASS FURNACES.

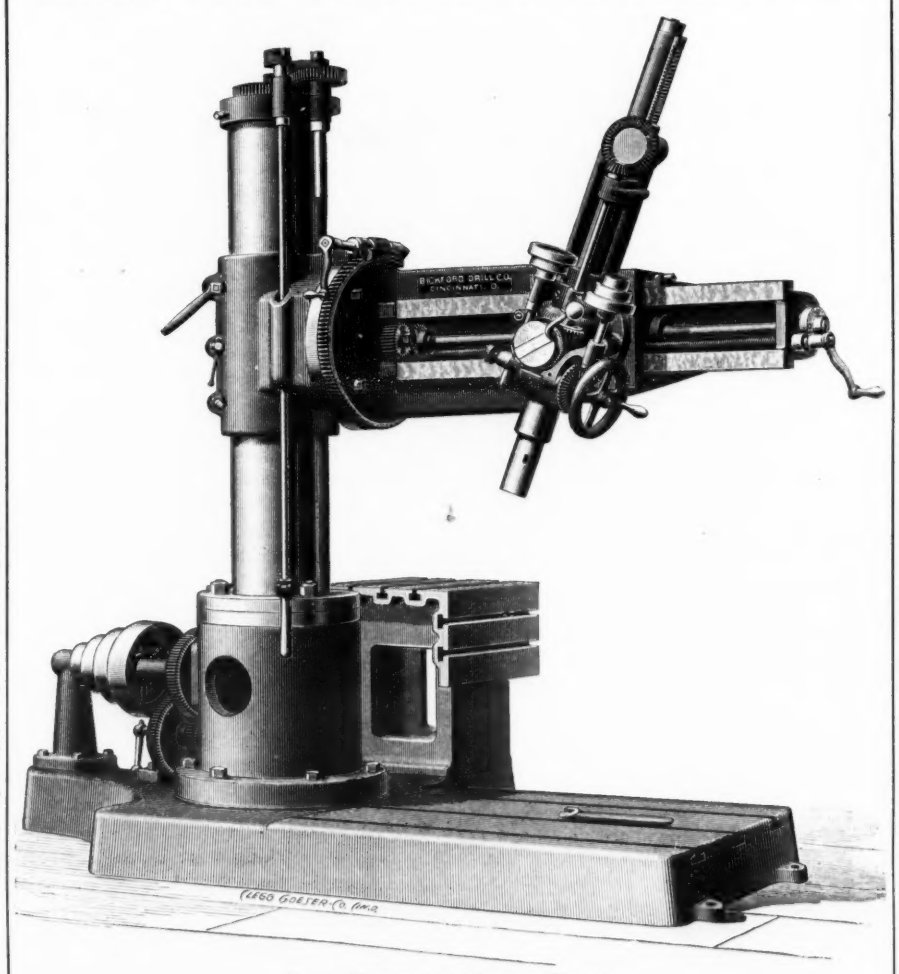
Full Universal Radial Drill.

The engraving shown herewith represents a universal radial drill, termed "Style B," which has just been placed on the market by the Bickford Drill Co., Cincinnati, O.

The base-plate of this drill is heavy and deep, ribbed and braced on the under side to avoid springing. The column, with a large round base, is bolted rigidly to the bottom plate, and over this, with long bearings on top and bottom, is fitted the outside sleeve or column. This column rests at the bottom on a large flange provided with roller bearings, which enables the operator to rotate the arm very easily. It is also fitted with three clamping bolts to fasten the column while drilling. The rotating arm, fitted over the outside column, is of a box form, and is deep, and strongly braced on top and bottom. It is made in two parts, and raises or lowers by power. The extension which carries the spindle is clamped to the sleeve part by four clamping bolts, and is provided with teeth on the outside of the flange at the sleeve, into which a worm operates to revolve the arm around its own axis. The drill head which carries the spindle also rotates, thereby making it possible to drill in any direction, or at any angle within the range of the arm. For drilling holes vertically downward, the arm and swing are provided with dowel pins, securing them so that any number of holes may be drilled parallel to each other.

The driving is done from the cone pulley shown on the back of drill, and by means of miter gears through the inside of column to top. The machine is back-geared; the spindle has automatic feed, and is fitted with patent quick-return motion.

A box table slotted on the top and side, and countershaft with tight and loose pulleys, are furnished.



FULL UNIVERSAL RADIAL DRILL.

The Form of Brass Furnaces.

BY ALEX. CAIRNS.

As reference has been made previously to defects in the design of brass furnaces, it may be well to refer to some of them briefly.

The greatest heat in the fuel of a furnace is usually at about midway of its height, and not at the top, as is the case in some other furnaces. This point seems to vary, however, with the temperature of the entering air, being higher the colder this air becomes, and *vice versa*. Now it is well known, of course, that air expands as it becomes heated, and assuming the entering air to be at a temperature of about 90° Fahr. at entering the grates and 2,500° at the melting point, there would be an expansion of about 5.9 volumes, and by reference to Fig. 11, which represents the ordinary form of furnace, it will be seen that there has been no provision made for this. A 24" furnace made in this way has a practical grate area of about 288 square inches. About 54 per cent. of the bulk of coke is solid, and on an average it can be safely said that there will be about 25 per cent. of this, or 72 square inches, for the passage of air.

At *B* on a line with the base of the crucible is the melting point, and, as the air at this point is 5.9 times larger in bulk than the same air at the grate surface, it will be seen at once that no provision has been made for the expansion of the air at this point. Such being the case, it must be concluded that the allowance at the grate surface for a volume of air 72 square inches in area is too large, and that the amount of air entering the fuel at the grates is measured by the amount passing the melting point in its expanded state. Between the lines *B* and *B'* is the point occupied by the crucible; it will be at once apparent that the bulk of the crucible has displaced a similar bulk of fuel, to make up for which no enlargement of the furnace has been made, which has had the effect of lengthening the time required to take off a heat, on account of the fuel around the crucible not having sufficient bulk to last through the heat.

Arriving at the flue shown at *c*, it is found that provision has been made for a volume of air 4"x4" to escape. Briefly, then, in view of the fact that no more air can reasonably enter the furnace than passes out of it, it is conclusive that the flue has gauged the amount of air entering the fuel at the grates, and that it is ridiculously small must be admitted. To this fact alone is the usual stopped-up condition of the grates due.

From the conditions that have just been enumerated it will be seen that, roughly speaking, the conditions necessary are nearly opposite to what they are, the two vital points being to get increased air space in the fuel by enlarging its bulk at the point where the greatest expansion of the air from heat occurs, and to have sufficient provision made for the escape of the air in its expanded state through the flue.

Owing to the somewhat variable conditions in a brass furnace, the theory laid down does not exactly hold good in practice, for the simple reason that the fuel does not immediately attain the degree of heat that would expand the air 5.9 volumes, and for this reason the grate surface *a*, shown in Fig. 12, is somewhat larger than would seem necessary.

From the grate surface to the line of the melting point *b*, Fig. 12, provision has been made for the expansion of the air in the fuel, as much as possible, by enlarging the amount of air space in it and still having the base of the furnace conform to the shape of the crucible.

The bulk of fuel around the crucible should be equal to the bilge diameter of the same, on all sides, for the purpose of having sufficient fuel to last through the heat, which does away with the necessity of renewing the fuel around the crucible at intervals during the heat, which chills the metal in the pot and delays the heats.

The flue shown at *c* should be approximately 12" square, or as much larger as its volume of air is larger than at the temperature of the same air found at the grates.*

It should be provided with a damper to regulate the draught during the latter part of the heat.

It may be remarked here that, while the tendency in brass furnace construction has been to confine all the heat possible in the furnace; there does not seem to be any very good reason for doing so. There is a limit to the use of heat in a brass furnace, and that limit might be defined as being anywhere below the temperature of the fuel at the melting point, and, as gases below that temperature do not assist in melting, they are of no use, and should be got rid of as soon as possible.

The Maine man who cannot turn his hand to another source of profit when one fails him is a scarce article. An engraver and carver of old-time repute in the palmy days of Maine shipbuilding, now a resident of Kittery, finding his occupation gone as a sculptor of figureheads for vessels, is engaged in making idols and graven images for the heathen! He has a large order that will employ most of his time for over two years.—The *Kennebec Journal*.

*The writer has had no means of determining the temperature of the air at the flue, other than by finding that the heat is great enough at times to melt tin, and occasionally antimony, and the temperature must then be between the melting points of the two metals, which would make the volume of air at the flue, on an average, 12 times the volume at the grate surface.

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NEW YORK, MAY 26, 1892.

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Inspection and License Laws.

Since the organization of associations and orders of stationary engineers, there has been more or less of effort on the part of these associations and orders to bring about the enactment of laws compelling the inspection of boilers and the examination and licensing of engineers. That such laws should prevail is, we believe, no more than right, and something that the general public is quite as much interested in as are engineers, as a class. Such laws are in the nature of efforts to protect human life and property, without injury or serious inconvenience to any one—laws that will tend not only to greater safety, but as well to the more economical operation of steam plants.

Of course the question of economy is one that stationary engineers cannot press as an argument for the necessity of inspection and license laws. No law can be passed—and there is no necessity for it—that will prevent the users of boilers and engines from permitting, through incompetent management, the waste of as much fuel as they can pay for, or sending their engines and boilers to the scrap heap as fast as they can buy new ones. But facts can be cited by engineers that will interest those who pay coal and repair bills, and such facts will be important in disarming opposition. While the main effort of engineers is in the direction of showing the protection to life and property afforded by inspection of boilers and the licensing of engineers, there is excellent room for argument in the line of the economy due to both inspection and license laws.

The condition of politics in this country, and the fact that stationary engineers are not in the "ring," makes the work of getting inspection and license bills seriously considered by a State or city government somewhat difficult. Engineers are not in the habit of paying money for votes in their favor. The most ignorant ward politician can tell them why the measures they advocate so commonly fail. We hope they will never come to spending money for votes. Let the crusade be an educational crusade, and then success will mean something. There is nothing unreasonable asked for by the organizations of stationary engineers. The more scrutiny there is of their proposed methods, the more likely they will be to succeed.

There are, in this country, two classes of men, both more numerous than is desirable, that are responsible for a large percentage of boiler explosions. One class comprises owners of steam boilers who are willing to have them operated when known to be in a dangerous condition, taking the chances. It seems strange that men should be thus heedless of the lives and property of others, but it is a fact that there are such men. And they will pay the least possible amount in wages that will secure the services of any one who can shovel coal. They take the risks on just about the same principle that the sanguine gambler, who always expects to win, does. Nothing but strong inspection and license laws, rigidly enforced, will restrain such men from endangering life and property.

The other class consists of men who are willing to operate boilers that any man of intelligence would pronounce unsafe. No matter what the condition of a boiler may be, some one can always be found who will run it, and he will call himself an engineer, too. Both classes of men named require the restraining influences of the law.

As an instance of the risk men will take in the use of unsafe boilers, a mechanical engineer in charge of works was appealed to by a man doing a manufacturing business in a thriving village out of town to find him an engineer. He was referred to a good engineer who happened at the time to be out of work. The engineer went to the place, and, after a brief examination of the boiler, flatly refused to have anything to do with it. The manufacturer found no difficulty, however, through an advertisement in a daily paper, in getting an engineer who "wasn't afraid." His immediate neighbors eventually took hold of the matter, and through threats of prosecution, brought about the calling in of the boiler makers, the foreman of whom, after careful scrutiny, refused to do any repairs. A new boiler was put in, which the cheap man succeeded in pretty effectually burning inside of two months. The owner always contended—and in his ignorance of such matters perhaps actually thought—that the boiler originally condemned was "good enough," and if he and those who worked for him were willing to keep it company, no one else had any business to find fault.

Boiler explosions are generally, but not always, due to ignorance. It sometimes happens that the familiarity which proverbially brings about contempt is responsible. But whatever the cause, thorough inspection and license laws are the best remedies at hand.

Selling and Buying Special Machines.

It is always bad policy for a manufacturer who expects to keep right along in business to sell a man something he does not need. In these days of invention, machines for special purposes are constantly being put on the market, and the purchaser depends a good deal upon the representations of the manufacturer as to whether a certain machine can or cannot be profitably employed by him. The temptation is in the direction of selling the machine, but it is generally unwise to make the sale unless it is what the customer requires.

If it is sold against the concealed judgment of the manufacturer as to its utility under the circumstances, and its purchase proves to be an unprofitable investment, as it probably will, the purchaser is fairly certain to lose confidence in the party who sold it, and will very likely go elsewhere with other orders.

In purchasing a machine for a special purpose there are generally several things to be considered. There must be work enough to keep such a machine in use a reasonable part of the time or the investment will prove a poor one. It would not pay, for example, to put in special machinery for finishing some article of which no more than a dozen were wanted in a year, requiring only a few days to make, while, on the other hand, if some hundreds are required then the machinery may be a valuable acquisition. And so with other machines where the work could be done, but with less rapidity, on a standard machine tool.

It may not, however, be a question of immediate results that should determine the advisability of using special machines and machinery for given purposes. It may be possible to see the way, by cheapening the product, to largely increase sales. All these things should be considered, and it is often that the manufacturer, or an intelligent salesman, can give a possible purchaser valuable information, thereby retaining his confidence and securing further orders in his lines. It is, generally speaking, quite as unbusiness-like for a manufacturer to sell a machine he knows the purchaser does not need as it is for the latter to buy it.

A Mean Business.

Not long since a man was held for examination in New York for swindling people out of money under the pretense of obtaining employment for them. This way of obtaining money is by no means uncommon, but as it is usually conducted in a small way, complaints are seldom made. At the present time there are a good many men out of employment, and many of them will take almost any chances of securing something to do. It is at such times that unprincipled men find it particularly easy to work their swindling schemes on their unfortunate victims, often getting the last dollar which they have, without any intention of returning an equivalent by finding work for them. But although there are better opportunities for this victimizing business when a considerable number of men are unemployed, there is always a desire to find work that pays better, or that is more desirable for other reasons, and this desire gives the labor brokers their opportunities. It is, however, when the unfortunate unemployed are victimized that the operation gets down to an extremely low depth of meanness.

If there is work to be had there are ways by which men may find it for themselves, or legitimate and comparatively inexpensive ways in which they can let their wishes be known to the public. If there is no work to be had, no one can, of course, find work for them.

If men will agree to pay brokers for finding them situations, they should pay only when they obtain these situations through the influence of the "agent." This is a safe rule; for while there may be honest men in the business of finding employment for others, there are for every one such, in the larger cities, a dozen rogues, a few only of whom are ever brought to justice. When men are found practicing that especial meanness that takes the direction of swindling those whose very anxiety for work by which to support themselves and families renders them unwary, they should be punished to the full extent of the law, and if necessary more stringent laws should be enacted for their punishment.

Overrating Steam Engines.

It is sometimes the case that steam engines are overrated by manufacturers, as to power. This is partly due to the sharp competition in the steam engine trade and partly to a desire to get, or to appear to get, a good deal of power into small space. It is one thing to demonstrate that an engine can be made to develop a given horse-power, and quite another to run that engine economically year in and year out developing that amount of power. A steam engine is, speaking, from an engineering standpoint, of no greater power than it will economically work at continuously, or practically so, without requiring constant humoring.

But there is one redeeming feature in the overrating of engines. That is, the power required is in the majority of cases over-estimated, or a large margin is left for possible future requirements, so that the power actually required is below that called for in the purchase, and the engine is better adapted to the work than if operated at its rated power. While this does not excuse the practice of selling engines under too high rating, it is sometimes a disguised blessing to the user, for it is a fact that is well known, that an under-loaded engine—an engine too large for the work it has to perform—will show poor economy in spite of all attempts to remedy it by varying the steam pressure or speed, although something may be accomplished by the latter means.

Occasionally the overrating business works badly. Instances sometimes occur where the power required is under-estimated rather than over-estimated, and without any reference to economy it has been found impossible to get the engine to work at the power at which it was rated in the sale, which is bad for the builder.

Literary Notes.

SAFETY VALVES: THEIR HISTORY, ANTECEDENTS, INVENTION AND CALCULATION. Including the most recent examples of weighted and spring-loaded valves. Also showing the effect of atmospheric pressure on safety valve disks, showing the curious phenomenon of balls being sustained by an inclined current of air; vacuum valves and their importance in heating and boiling. By William Barnet Le Van, Member of the Franklin Institute and the American Society of Mechanical Engineers.

The author has evidently read much relating to the safety valve, and has compiled a book which, although it does not possess much originality, may be interesting reading to those who are not familiar with the history of the safety valve, its action, general design, and the different types at present in use. The principles on which the operation of the safety valve depends are explained, and an attempt has been made to present the subject in simple language free from all technicalities. Formulas for computing the equilibrium of the load and pressure on the valve are given, and, for those readers who do not understand formulas, rules in ordinary language are given.

The book contains much that is useful to those who have charge of steam boilers or

who are interested in the action of safety valves. The author uses a few incorrect expressions; for instance, *static momentum* in place of *moment;* but such need not lead the reader astray in the applications of the formulas. The book is published by Norman W. Henley & Co., 150 Nassau street, New York. Price, $2.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(228) J. W. R., Chicago, Ill., writes: Please inform me how a wire rope is spliced and how the ends are fastened. *A.*—You will find a complete description of this, with illustrations, in answer to Question 45, in our issue of January 28, current volume.

(229) D. G., Brooklyn, N. Y., writes: If I drop two balls of the same size down a chimney 300 feet high, both being polished, one made of brass and the other of wood, would both drop with the same speed or not, and why? Some say they would, and others do not think so. *A.*—The brass ball will drop with the greater speed, because, it being heavier than the wooden ball, it has a greater power to overcome the resistance of the air. In a vacuum they will drop with equal speeds.

(230) R. F. D., Englewood, Ill., writes: Kindly publish for the benefit of several readers the best recorded performance in water consumption of ordinary high-class Corliss engines as follows:

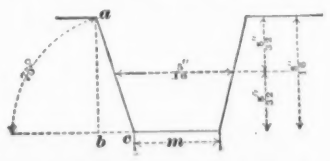
Single cylinders..... non-condensing.
Single cylinders..... condensing.
Two cylinder compound..... non-condensing.
Two-cylinder compound..... condensing.

Also what would be a fair and reasonable expectation from the above-mentioned engines. *A.*—The best recorded performance that we can remember is 12½ pounds of water per indicated horse-power per hour for a compound engine; but cases of this kind are exceptional cases. A fair and reasonable expectation of water consumption can be estimated by the following rules. For first-class non-condensing simple engines cutting off at about ¼ stroke, divide the constant 200 by the square root of the initial pressure; the result will be water consumption per horse-power per hour as accounted for by the indicator. Thus, if the initial steam pressure is 100 pounds then the water consumption per horse-power per hour is

$$\frac{200}{10} = 20 \text{ pounds.}$$

To this should be added about 24 per cent. for internal condensation. For first-class condensing simple engines divide the constant 150 by the square root of the initial pressure, and add 28 per cent. for internal condensation. For compound engines the water consumption will be about 10 per cent. less than that found by the above rules.

(231) C. A., Pittsburgh, Pa., writes: Would there be any advantage, that is, would there be any power gained by an engine having a valve arranged so that, when the steam has performed its office it will open the valve port instantly to its full capacity and drain the cylinder? Or does the dead steam, when making its escape, offer no resistance to the motion of the piston in a slow or high-speed engine? I have an idea which I think could be put into practice on a slow-speed engine. For this reason I would like to be informed. *A.*—



This point has not been overlooked by designers of first-class engines. In these, the steam has sufficient time to escape, and the resistance due simply to the opening of the exhaust ports amounts to practically nothing. Of course in non-condensing engines the back pressure will always be more or less greater than the atmospheric pressure, but this is due to the friction of the steam or vapor in the passages in making its escape, and will not be materially affected by the sudden opening of the exhaust port. 2. I would also like to know how to find the distance across the top of a compromise thread as shown in the sketch. Say, for instance, the pitch is ⅛ inch, and the thickness of thread half way down is $\frac{5}{16}$ inch, it is also $\frac{5}{16}$ inch deep. Now what I want to know is the measurement across the small part *m* of the tooth, and how do you compute it? *A.*—Assume that a line *a b* has been drawn through *a*, perpendicular to the top and bottom of the thread, and meeting *m* produced in the point *b;* *a b* will then represent the sine of the given angle of 75 degrees, and *b c* its cosine. Referring to a table of natural sines, etc., we find that the sine for this angle is .9659, and the cosine is .2588, which simply means that, if *a c* is 1 inch, *a b* will be .9659 inch, and *b c* will be .2588 inch. But according to the conditions of the problem *a b* is $\frac{5}{16}$, or .3125, which is less than the value taken from the table; and since *b c* will decrease in the same ratio, we have the following proportion:

$$.9659 : .3125 :: .2588 : b\,c\,;$$

from this we find *b c* equal to

$$\frac{.3125 \times .2588}{.9659} = .0837 \text{ inch.}$$

Subtracting this from the thickness at the center of the thread we have .3125 — .0837 = .2288 inch for the width of *m* You can also find this in another way. The sum of the angles in the triangle *a b c* is 180 degrees; the angle *c* is given, it is 75 degrees; the angle *b* is 90 degrees; hence the angle *a* will be 180 — 165 = 15 degrees; the tangent of an angle of 15 degrees is .2679; multiplying this tangent by $\frac{5}{16}$ = .3125 we have .2679 × .3125 = .0837; subtracting this product from .3125 we have .3125 — .0837 = .2288 inch as before for the width *m*.

(232) S. W., Brooklyn, N. Y., writes: Please inform me what is the difference between a hard and a soft patch on a boiler; which one should be put on the crown sheet? And should it be put on the inside or outside of the sheet, and why? If put on the outside, A. claims it will form a pocket for scale to collect, and B. claims if put on the inside there will be no advantage gained. Which one is right? The patch is to be 3½ feet from front flue sheet, and in the center of crown sheet. The feed enters at the bottom of the rear end of boiler; the feed pipe is run to within 18 inches from the patch; the boiler is 4½ feet diameter and 16 feet long. *A.*—A soft patch is one which is bolted to the boiler, and is made tight by means of red lead or some similar substance. A patch of this kind is seldom used for a high steam pressure. A hard patch is one which is riveted to the boiler and calked. Sometimes a hard patch is screwed to the boiler by means of screw bolts, the boiler sheet is tapped, and the holes in the patch are countersunk to a conical form, and receive the heads of bolts of a corresponding form; the outer portions of the heads have the appearance of rivet heads. In other cases the holes in the patch are not counterbored, but simply faced off square with the axes of the bolts by means of a rotating cutter after the patch has been put in place, so as to obtain a good fair bearing for the bolt heads. In either case, when the job is done it is difficult to decide whether the patch has been riveted or screwed to the boiler. We prefer not to put a patch of any kind on the crown sheet; it is better and safer practice to put in a new crown sheet; but if necessity demands a patch we should use the hard patch, and, if possible, put it on the inside of the boiler, which will tend to prevent any sediment collecting on it, and avoid the danger of burning it. Another advantage of placing it inside is that the stress on the bolts will be much reduced. The disadvantage of placing it inside is that the patch cannot be readily calked; in fact, it may be an impossibility to do so, and therefore the patch will have to be put on the outside of the crown sheet, which, in our opinion, is a dangerous practice. 2. Is it good practice to keep the valve closed on feed pipe between the check valve and boiler when not feeding? *A.*—It is bad practice to close this valve, excepting in a case of emergency, as there is a danger of neglecting to open it when the boiler is doing duty. 3. Is there any difference between the terms "high duty" and "high pressure" steam pumps? *A.*—The term "duty" refers to the economy of the pump or pumping engine. It is the number of foot pounds of work done by the consumption of 100 pounds of coal. Thus the duty of a pumping engine that will do the equivalent of lifting 100,000,000 pounds one foot high for 100 pounds of coal consumed is said to be 100,000,000. This has no reference to the capacity of the engine or the pressure. The term high-pressure pump simply refers to the comparatively high head or pressure against which the pump is capable of working.

(233) F. F. D., Worcester, Mass, asks: Which will raise the heaviest load—a screw 1 inch in diameter or one 12 inches in diameter? The pitch of thread of both screws is 4 inches, the power applied is the same in both cases; in fact, everything is the same excepting the diameter. This is a question that has been asked in the shop and has been left for you to answer as fully as you can. *A.*—In the following we shall assume for the sake of simplicity that the given diameters of the screws are the mean diameters (that is, midway between top and bottom of thread). Let *A B* represent the circumference of a cylinder whose diameter is equal to the mean diameter of the screw, and *B C* the pitch. Also let *W* denote the weight lifted, including the weight of the screw, *f* the coefficient of friction between screw and nut, and *M* the turning moment. The screw is then acted upon by *W*, *M*, the normal pressure between its thread and the nut, and the friction between these. By normal pressure is meant a pressure perpendicular to *A C*. This force and that due to friction is distributed over the whole length of *A C*. Let us denote the total normal pressure on *A C* by *R*. If now *a c* represents the intensity with which *R* acts, then *a b* will represent the intensity with which it acts in a vertical direction, or, in other words, *a b* is the vertical component of the force *R*. But *a b* represents the cosine of

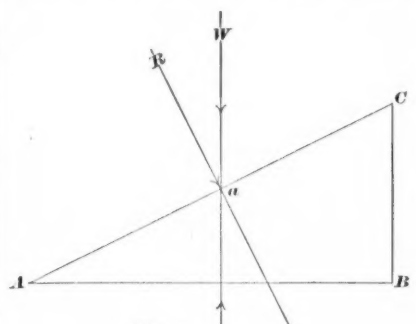


Fig. 1.

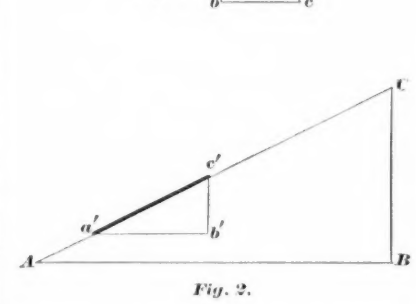


Fig. 2.

the angle *a;* hence the vertical resultant of all the normal pressures = $R \times cos.\ a$. The friction acts along the line *A C*, Fig. 2. Let *a' c'* represent the force due to friction; this force can be resolved into two components, *c' b'* being the vertical and *a' b'* the horizontal component. But *c' b'* represents the sine of the angle *a*. Hence the vertical resultant of all the small frictional forces = $f \times R \times sin.\ a$. Hence $R \times cos.\ a$ balances *W* and $f \times R \times sin.\ a$, or in symbols

$$W + f\,R\ sin.\ a = R\ cos.\ a,$$

from which we get

$$W = R\,(cos.\ a - f\ sin.\ a).$$

The horizontal frictional component *a' b'* is one of the resistances to the turning of the screw; but *a' b'* represents the cosine of the angle *a;* hence one of the resistances is $f \times R \times cos\ a$. In Fig. 1 the horizontal component *b c* of *R* gives another resistance to turning, and since *b c* represents the sine of *a* we have for this resistance $R \times sin.\ a$; but *b c* and *a' b'* act in the same direction; hence the total resisting moment will be

$$R\,(sin.\ a + f\ cos.\ a)\ r,$$

in which *r* is the radius of the screw. During one revolution the energy exerted will be

$$2 \times 3.1416 \times r \times R\,(sin.\ a + f\ cos.\ a).$$

Work done = $W \times p$, in which *p* denotes the pitch; but we have already seen that $W = R\ cos.\ a - f\ sin.\ a)$; hence

$$W \times p = R\,(cos.\ a - f\ sin.\ a)\ p,$$

and therefore the efficiency of the screw is found by the following formula:

$$\text{Efficiency} = \frac{p\,(cos.\ a - f\ sin.\ a)}{2 \times 3.1416 \times r\,(sin.\ a + f\ cos\ a)}$$

Now let us find the efficiency of the 1-inch screw. In this case *A B* will be 3.1416 inches long, and *C B* 4 inches long. The sine of the angle *a* will be equal to .786, and the cosine = .617; if we take .18 for the value of the coefficient *f* of friction, and substituting these values for the symbols in the formula, we have for the efficiency =

$$\frac{4\,(.617 - .18 \times .786)}{2 \times 3.1416 \times .5\,(.786 + .18 \times .616)} = .67;$$

that is to say, under these conditions 67 per cent. of the power applied will be expended in useful work. Now let us find the efficiency of the 12 inch screw. In this case the sine of the angle *a* will be .1056, and the cosine will be .9943; again taking *f* = .18, we have efficiency =

$$\frac{4\,(.9943 - .18 \times .1056)}{2 \times 3.1416 \times 6\,(.1056 + .18 \times .9943)} = .36;$$

that is to say, 36 per cent. of power applied will be expended in useful work. This shows us that power is saved by using the small screw, and that we should not use a screw larger in diameter than strength demands. It can be shown that the foregoing formula for the efficiency reduces to

$$\text{Efficiency} = \frac{1 - f\ tan.\ a}{1 + f\ cotan.\ a'}$$

which gives the same result with much less labor.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Grant Gear Wheels, Gear Cutting, page 20.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Forming Lathes, Mer. Mach. Tool Co., Meriden, Ct.

Ideal Drawing Stands. M C. Hammett, Troy, N Y.

A. D. Pentz, Consulting Tools. Elizabeth, N. J.

Armstrong Tool Holder. Armst'g Bros., Chicago.

Ag'ts & sub's w'td. Scientific Machinist, Clev'd, O.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

The Improved Justice Hammer. Williams, White & Co., Moline, Ill., manufacturers.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

S. A Smith 23 S Canal St., Chicago, Ill., is agent for Holbrook's new loaded rawhide mallets.

"Boiler Tests by Barrus." Get sample pages from Gowing & Co., Mason Building, Boston, Mass.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker St., Philadelphia, Pa.

For best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th St., N.Y. Send for des'n.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson St., Chicago, Ill.

25" / 32" / 37" / 42" — "Only Drill Press built on 'Ko-rekt' principles, Even if they come from Jersey," Gould & Eberhardt, New Ark, N. J.

Just Pub.—Safety Valves, History, Invention & Calculation. By W. B. LeVan. Fully ill. $2. Cat. of Machinists', Electricians' & Engineers' books sent free. N. W. Henley & Co., 150 Nassau St., N. Y.

S. W. Card & Co., Mansfield, Mass., are putting on the market a new line of stocks and dies, with their patent adjustable dies and guide. S. A. Smith, 23 S. Canal Street, Chicago, Ill., Western Agent.

Patent Soliciting of High Class.
D. Walter Brown, Counsel in Patent Cases.
31 Nassau Street, New York.
Send for Brief History of Patent Legislation.

We will pay 25 cents each for copies of the AMERICAN MACHINIST of December 25, 1886 issue; must be unsoiled, and in good condition. AMERICAN MACHINIST PUBLISHING COMPANY, 203 Broadway, New York.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc Location and equipment well adapted for Heavy Steamship Repairs.

Just Published: "Ways & Means" for Machinists & Metal Workers. A new work, thoroughly practical, containing new matter that no intelligent mechanic should miss. The cheapest work ever issued, 160 pp., 150 illustrations, including working details of the latest mach. tool design & prac. Cloth. Price $1. John W. Weston, Pub. Journal of the Association of Eng. Societies, 78 La Salle St., Chicago.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING CO., 203 Broadway, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

Locomotive Matters.

By W. H. BOOTH.

Mr. W. E. Crane comments upon my remarks respecting the fire brick arch, or the want of it, in American locomotives. I note Mr. Crane says that brick arches are now universal in American practice. If so there must have been a very rapid change in practice in a very short time.

He refers to a "sheet-iron deflector" which appears worthy of investigation. This is generally termed the deflector plate, and it is introduced, as Mr. Crane observes, by the shovel, and being made to the curve of the opening of the fire door, it is self-holding, because, as I have tried to show in the accompanying sketch, page 10, the flanged end which comes against the back plate of the fire box is of a longer curve than half the fire door periphery, and the plate in a sense joins itself firmly.

The original length of a deflector plate such as to almost reach the brick arch, and they are usually continued in service until they are burned to half length. They serve to effect smokeless combustion in conjunction with the brick arch.

Mr. Crane makes a mistake when he

speaks of trains here being run with two locomotives, as though this were necessary.

He will only see this as a rule at one London station, and the reasons are that by that line trains are run together into the country, which afterwards divide and go in different routes, but which return to London as two trains, so as not to wait for each other at the country junction, and consequently there are locomotives to be sent back to the country, and it is a rule not to send an "empty" engine if it can be attached to a train.

But if Mr. Crane will go to any other station not above a thousand yards or so from the one to which he refers, he will see equally heavy trains run by single engines, and he will find that the speed made is higher than on the line he knows. Concerning this point I would remark here that while I am constantly up and down all the English main lines I very rarely indeed see Americans on our two best railroads. Americans, as a rule, know only one way to London, and so they miss all the best English locomotive practice, and when they leave London southwards they see the very worst railroad practice we can show them, or any one else can show them, for that matter. Mr. Crane would have perhaps not written much of the last paragraph in his letter had he been in Manchester, York or other centers. His item of four wheels per car is so evidently picked up south of London that I fear his daylight journeys were performed only in that locality.

Twelve wheels is more truly representative of present English practice.

I should rather like to know where Mr. Crane picked up the joint information of single-wheel engine and four-wheel cars, if not south of London, for he would only see "apparently heavy locomotives" elsewhere of the single type in conjunction with cars of 6, 8 or 12 wheels.

English locomotives, as Mr. Crane observes, *are* usually inside connected on the routes which he knows, but on those he clearly has not seen they are as often outside connected when single. On one line it is quite rare to see any engine which is not outside connected; but both varieties occur on nearly every line in the country.

"Freight" engines, however, are generally almost universally inside connected and are practically alike all over the country; for freight trains are usually short and light and run at a good speed, though with the doubling of lines there appears a tendency to reduce freight speeds, these trains running on the two slow tracks.

All the main lines are now pretty well four-tracked throughout. Cylinders of freight engines are usually 18″x24″; of passenger engines from 16″x22″ for old engines of 30 years ago to 18½″x28″ and 19″x26″ for newer engines. Wheels for freight engines vary from 36″ to 60″, probably 48″ being the most usual.

In passenger work 66″ is considered small. Coupled engines are perhaps more usually 72″ for ordinary work up to 78″; for express work the coupled wheels will be 84″, and for single engines they vary, as a rule, between 84″ and 98″. I believe there are now no 108″ wheels remaining, as formerly run on the Bristol & Exeter line, which is 7 feet gauge.

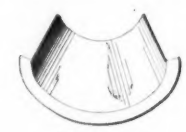
From these figures Mr. Crane will perceive that no ordinary American locomotive could "play" with such trains as the above engines *can* take; that is, if steam pressure and cylinder dimensions have anything to do with the power of an engine. In compound locomotives the largest cylinder here is 30″; but this is single only, and equivalent to a pair of 21¼″ cylinders.

The recently built "Vauclain" compound has two 22″ cylinders, and these turn 78″ wheels.

This engine is, therefore, more tractively powerful than the English compound, which has 78″ wheels, but less powerful than other English compounds, which have only 72″ wheels for 30″ cylinders.

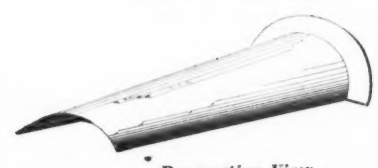
There are, as a fact, now locomotives running in America, and receiving praise for their performances, which have larger wheels than many English express engines, although this item of large wheels has been much scouted. It is, of course, a natural concomitant of high speeds, and seeing that in the eastern States, on good track, American railroad speeds are in some instances as high as English speeds, it is equally probable that single pairs of driving wheels will become a feature of American engines, as they are here. It is worth noting that there is no scheduled speed in England equal to certain scheduled and accomplished speeds of 30 years ago and over, which seems to show that the improvement of the locomotive has not kept pace with the demands made on it, and forty years ago there was probably a larger proportion of high-wheel engines than now.

My recollection of English locomotives takes me back to a time when the engines on a certain railway were many of them carried on four wheels, only all coupled. The valve chests were below the cylinders and very near the ground. The frames were of



End View

Side Elevation



Perspective View

the bar type, and the wheels exposed just as they now are in American practice, and they had cast iron bosses cast onto round spokes of wrought-iron and with iron tires.

The fire boxes were circular in plan, and had the general appearance of an old-fashioned straw beehive.

I am much inclined to agree with Mr. Crane in what he says as to the double-crew system of working. There are, of course, the objections I have named previously as regards the special care of one man for his own engine, which cannot be had where an engine passes from hand to hand; but given good water I can see no reason why locomotives should not be run very much greater mileages than at present, nor do I see why so much time now spent in washing out and the space taken up by the extra engines, necessary by reason of all this washing out, could not be better employed in purifying water before putting it inside a costly boiler to produce burned sheets, priming and scored valves. Where is the sense in this?

With pure water—even ordinarily pure—boilers will run weeks and months, and then have no scale. Surely the waste of blowing off, the cleaning time, and the damage, must be big enough to warrant better attention than has yet been accorded this subject. I hope Mr. Crane will pardon my criticisms; but his remarks seemed to imply, though he may not have meant it, that the cylinders of English locomotives were very much smaller than those used in America. This, however, is not the case, and I suppose all the world over that cylinder area × steam pressure has an equal significance to mechanical engineers. Knowing this, Mr. Crane should naturally have inquired the reason for attaching two engines to a train, and he might have learned this, and also that the practice is peculiar to one railroad only to a marked extent, and this because of the peculiar nature of its traffic.

We are reminded that the national holiday is drawing near, by receiving from the Mason Regulator Co., of Boston, Mass., a genuine fire-cracker—in appearance. But alas for the small boy! it is in appearance only, an inspection that is suggested by its looks revealing the fact that it is loaded with a non-explosive little folio, the printing upon which relates to something of interest to steam users and engineers.

MANUFACTURES

John Talley will start a machine shop at Terrell, Texas.

The Carrollton Railroad Co. will erect an electric power plant at New Orleans, La.

A $12,000 electric light plant will be built by Westfield, N. Y., under legislative act.

The Baltimore (Md.) Traction Co. will erect an electric power plant to operate the Pikesville Railway.

While the Lansing (Mich.) Iron and Engine Works are closed for inventory, extensive alterations will be made in the plant.

Arrangements have been made for the erection of an electric light plant in Newport, Tenn. C. F. Briggs can give information.

The Wichita Falls (Texas) Electric Light and Power Co., recently chartered, will erect a plant in the near future. Edwin Fish is secretary.

The city of New Braunfels, Tex., will build a steel standpipe and otherwise improve its waterworks; $9,000 of bonds will be issued to defray expenses.

The Owego Bridge Works will soon have the plant of the old Southern Central shops at Owego, N. Y., in shape for the manufacture of iron and steel bridges.

The Short Electric Railway Company has removed its office from 225 Dearborn street, Chicago, Ill., to the new Monadnock Building, corner Dearborn and Jackson streets.

Bedford, Ind., will have water-works, two new depots, a new foundry and machine shop, and a new stone-mill, in the coming summer, besides the opening of several new quarries.

It is reported that the Milwaukee Bridge Co. has arranged for the removal of its plant to Jackson, Mich., and expects to have its new works in operation in July, employing about fifty men.

The Niles Tool Works, Hamilton, Ohio, has issued a circular illustrating their No. 5 cylinder boring machine, for boring cylinders, facing ends and boring valve seats of Corliss engine cylinders.

The Florence (S. C.) Iron Works has obtained charter; plant is in operation. R. C. Commander, Jr., president; S. A. Gregg, Jr., vice-president, and M. J. Walsh, secretary; capital stock, $10 000.

The iron framework for one of the two new mills of the Sterling Steel Co., in McKeesport, Pa., has been raised. The building will be 75x100 feet. The other building will be pushed forward rapidly.

The Delbert Engineering Co., Limited, has been incorporated, with a capital stock of $100,000, at New Orleans, La. Alphonse F. Delbert is president, and Timothy F. Regan secretary and treasurer.

The Central Bridge and Engineering Co., of Peterborough, Limited, has applied for incorporation in Ontario, for the purpose of manufacturing steel and iron bridges and structural work. The capital stock is $200,000.

The Latrobe Steel Works, Latrobe, Pa., is extending its machine shop equipment. This addition, with the tools which it will contain, will increase by about 50 per cent. the capacity of the firm for manufacturing tiers.

H. A. La Paugh has taken the general eastern agency of the Detroit Graphite Manufacturing Company, and has opened an office at 233 Broadway, New York, where a full line of samples of L. S. G. graphite paint will be kept.

The Eureka Wood Pulley Co., of Berlin, Pa., are putting up buildings 100x25 feet and 30x80 feet, of iron and wood. They will need two boilers, 5x14 feet, an engine of 45 horse-power, lathes, pulleys, shafting, elevator, and steam heating apparatus.

The Baltimore & Ohio Southwestern will establish general repair shops at Chillicothe, O., the final agreement having been made this week, when the city council passed an ordinance asked by the railroad. The matter has been under discussion about two years.

The foundry and machine shop at Newcomerstown, Ohio, formerly known as the Oxford Machine Works, has been purchased by A. F. Ward, and will be run hereafter on special machines, and steel tools and contract work generally, iron, brass and composition castings, etc.

The Lunkenheimer Brass Manufacturing Company, Cincinnati, Ohio, has issued an attractive illustrated catalogue of brass and iron goods and specialties. They manufacture a large variety of valves, cocks, safety valves, oil cups, water lines, steam whistles, cylinder oilers, etc.

Alex. Adamson and J. W. Denmead, formerly with Webster, Camp & Lane Machine Co., have opened a machine shop at 225 South Howard street, Akron, Ohio, under the title of Adamson & Denmead. They will do general repair work, forging, and other work that comes in their way.

There is water-works agitation in Iowa Falls, Iowa.; Yonkers, N. Y.; Asheville, N. C.; Riverhead, N. Y.; Hanover, N. H.; Fulton, Ky; North Vernon, Ind.; Quincy, Mass.; Santa Rosa, Cal.; Sparta, Mich.; Kenton, Ohio; Cannelton, Ind.; Athena, Ore.; Wilmington, N. C.; Midway, Utah; Rushville, Ind.; Ticonderoga, N. Y.

The W. C. Leffel Co., Springfield, Ohio, write us: Finding The Leffel Water Wheel and Engine Company too long a name for convenient business use, we have adopted the name of our president, and will be hereafter known as The W. C. Leffel Co. We will esteem it a very great favor if you will kindly notice the change in your reading columns.

The Jos. Dixon Crucible Company, Jersey City, N. J., has issued a catalogue of graphite productions, including graphite paint, grease, belt dressing, lubricating oil, crucibles, and a large number of other productions into which graphite enters. Those who read the catalogue are likely to be astonished at the number of uses to which graphite is put.

The Jones & Lamson Machine Company, Springfield, Vt., has issued an attractive catalogue of more than 60 large pages, illustrating and describing "the 2x24 Flat Turret Lathe," built by them for general machine shop use. In addition to cuts of the lathe, there are illustrations of some of the work for which it is designed, and an interesting article on "Evolution of the Turret Lathe." It is an instructive catalogue; the illustrations are excellent and complete in detail, and printed on very fine paper.

The electric plant which is being erected by the Pennsylvania Steel Co., at Steelton, Pa., is being pushed to completion at a rapid rate. The iron rafters are being placed in position, and will be in place by the middle of the week, when preparation will be made to put the roof on at once. As soon as the large plant is under roof the interior of the building will be pushed to completion. It will be one of the best equipped electric plants in this section of the State. The power will be used to illuminate the large steel plant and for the driving of machinery.

We have from the Frick Company, Waynesboro, Pa., divisions 2, 3 and 4 of their catalogue. Division 2 relates to the eclipse high-speed automatic engine built at their works in a variety of sizes for electric light and power purposes, and for general work. This engine has a balanced slide valve and automatic governor. Division 3 refers to Corliss engines built by the Frick Company in from moderate to large sizes, simple and compound, and division 4 to refrigerating and ice-making machinery—small and large plants. All the catalogues are quite fully illustrated; the plan of issuing them in divisions, or sections, is a good one for busy people who want to consider one subject only at a time, or who are interested in one division only.

Work on the new shop of the Pennsylvania Iron Company, at Fiftieth and Lancaster avenue, Philadelphia, has begun. U. S. Lutz, the constructing engineer for the company, has charge of the work, and it is his intention to push it as rapidly as possible. The foundations of the main walls will be built of Conshohocken stone, the remainder of brick, the whole surmounted by an iron trussed roof. The dimensions are 230 feet long by 65 feet wide, 34 feet high. An immense lathe pit 105 feet long by 16 feet wide, and 17 feet 6 inches deep, will be built on a layer of concrete, with side walls of brick laid in cement. A traveling crane, propelled by electricity, and supported on tracks carried by fifteen piers on each side, that form part of the walls as they are carried up, spans the entire width and travels the full length of the building. No shafting will be used in this building; all the numerous and ponderous machines are to be provided with electric motors.

Machinists' Supplies and Iron.

NEW YORK, May 21, 1892.

Iron—American Pig—We quote Standard Northern brands, No. 1 Foundry, $15.75 to $16; No. 2, $14.75 to $15; Gray Forge, $13.75 to $14. Southern brands of good quality are obtainable at $15 to $15.50 for No. 1 Foundry; $14.25 to $15 for No. 2; and $13 to 13.50 for Gray Forge.

Scotch Pig—Coltness is quoted at $21; and $20.25 for Eglington.

Antimony—The market is steady.

We quote Hallett's, 11⅜c. to 11½c.; Cookson's, 14½c. to 14¾c.; and L. X., 13c. to 13¼c.

Copper—The market continues lifeless, but there is a disposition among consumers to pay 11.95c. for Lake Copper, and although 12⅛c. to 12¼c. are generally quoted, 12c will buy carload lots. Casting Copper is held at 11.25c. to 11.40c.

Lead—The situation remains dull and nominal at 4.22½c. to 4.25c. for carloads.

Lard Oil—The market is firm at 56c. to 57c. for Prime City. Western on spot is quoted at 55c. to 56c.

Spelter—The market is nominal at 4.80c. to 4.90c. for New York delivery.

Tin—The market continues strong, and speculative interest active. Sales have been made at 21.10c.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. Seven words make a line, and the address as desired to appear should be included. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Wanted—A position as foreman of boiler shop; good reference. Address G., AM. MACHINIST.

Wanted—A good well-tool blacksmith. Apply to F. F. Collins Mfg. Co., San Antonio, Texas.

Wanted—Good floor and vise men. Sioux City Engine Works, Sioux City, Iowa.

Pattern maker wants position; well up in general engine and machinework. BOX 5, AM. MACH.

An A1 first-class machinist desires to make a change; accustomed to tool and jig work, capable of taking charge of shop. T. O. T. E., AM. MACH.

Wanted, at once, three good machinists; long time job; light class work; two hours' ride from Chicago. BOX 2, AMERICAN MACHINIST.

Wanted—By steady, sober machinist, position in factory preferred, to look after and repair machinery. Address BOX 4, AMERICAN MACHINIST.

1st-class mech. draftsman, exp'd in steam plants, Corliss and slide valve eng., pumping and transmission mach'y, wants situation. R. S., AM. MACH.

Wanted—Position as foreman of machine shop or tool room; understands drawing and designing tools for interchangeable work. Box 46, Simsbury, Conn.

Wanted—First-class machinist, thoroughly capable to take charge of constructing hydraulic machinery. A young man with proper experience preferred. Address A. W. S., AM. MACHINIST.

Marine engineer, trained Clyde, Scotland, wishes situation, supt., ass't supt. or chief draftsman; thoroughly exp'd most recent 1st-class merchant & warship high speed engines. "Marine," AM. MACH.

Wanted—Man to take full charge of general machine shop as foreman; must know how to work modern tools; state age, and salary expected, and give references. Sullivan & Ehlers, Albany, N. Y.

Wanted—Position by mechanical draftsman, technical education, shop practice, exp. in general and power transmission mach'y. W. G., AM. MACHINIST.

Wanted—Tool makers on screw machine box tools, drill jigs, and on punching and forming dies for sheet metal. State age, experience, and wages wanted. Address Metric Metal Co., Erie, Pa.

Wanted—A draftsman; must have a thorough technical education, and be a good machine designer; none but competent men need apply. A permanent position State age, experience, reference, and salary expected. BOX 3, AM. MACHINIST.

The superintendent of an engine and boiler shop working 200 men, and owning patents of Corliss engines now being built, has $8,000 cash, 20 years' experience, desires an interest in a modern shop in the West. J. E. J., AMERICAN MACHINIST.

A thoroughly comp. man desires a sit. as working foreman or supt. of a mfg. establishment; extended exp. in modern methods on interchangeable work and mach. shop practice, devising tools & dapting mach'y to produce economical results; exp'd in electrical work, dynamos, machine tools, writing mach., etc.; thorough draftsman, good executive, details of contract and piece-work. E. H., AM. MACH.

✣ MISCELLANEOUS WANTS ✣

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd-lathes & planers. S. M. York, Clev'd, O.

Auto. Steam Flue Cleaners. Kelley Co., Erie, Pa.

Best Crank Shaper $225. Am. Tool Wks., Clev., O.

Ag'ts for mechanical paper. F. D. Leslie, Clev'd, O.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

THIRTY YEARS' EXPERIENCE.

Best facilities for manufacturing

Machine Specialties

from an ounce to twenty tons weight.

SPECIAL LABOR-SAVING MACHINERY designed and perfected. Plants furnished for the manufacture of anything on the interchangeable plan. DIES, TOOLS, Etc. Correspondence solicited.

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Providence, R. I.

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GARDNER C. ANTHONY, Director.

ANNOUNCEMENT.

Having new and improved features on Milling Machines, that we desired to place on the market, we have by mutual consent closed our contract with the parties heretofore making these tools. These improved tools we will offer in the near future, and trust they will receive the liberal patronage enjoyed by our other productions.

THE LODGE & DAVIS MACHINE TOOL CO.,

Cincinnati, Ohio.

TO LET.

The Engine Works at Newburgh, N. Y., at present occupied by Wm. Wright, is offered to let from May 1st, 1892.

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The works are located in the heart of the city, and convenient to railroad and river transportation.

For terms, apply to

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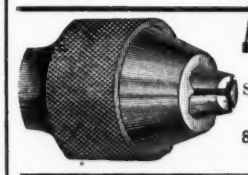

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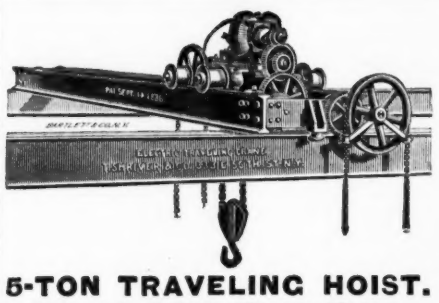

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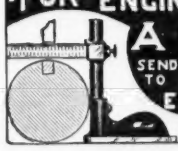

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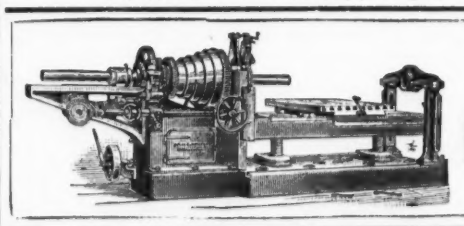

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24 do	12	do	do		Fitchburg
24 do	12	do	do		Flather
22 do	10	do	New Pattern		Fifield
22 do	12	do	do		do
22 do	12	do	New		Blaisdell
22 do	8	do	do		Flather
22 do	10	do	do		do
20 do	8	do	do		do
20 do	10	do	do		do
18 do	8	do	do		do
18 do	10	do	do		do
18 do	8	do	do		Blaisdell
18 do	15	do	do		do
16 do	6	do	do		Flather
16 do	6	do	do		Blaisdell
15 do	6	do	do		Flather
14 do	6	do	do		do
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30 do	30	do	8	do	Flather
26 do	26	do	6	do	do
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24 do	24	do	6	do	Whitcomb
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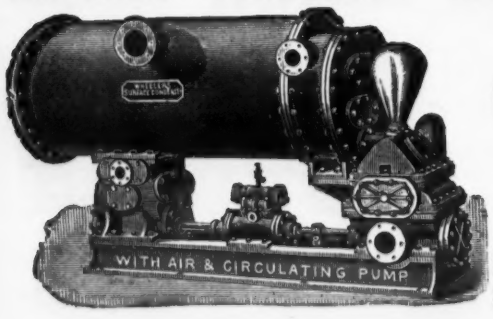

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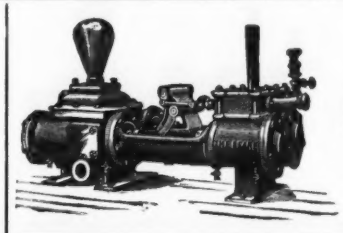

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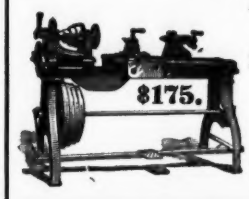

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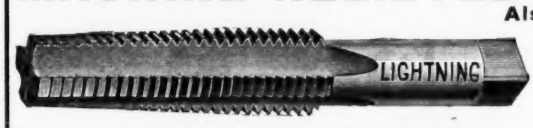

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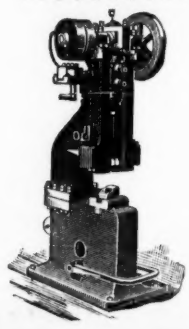

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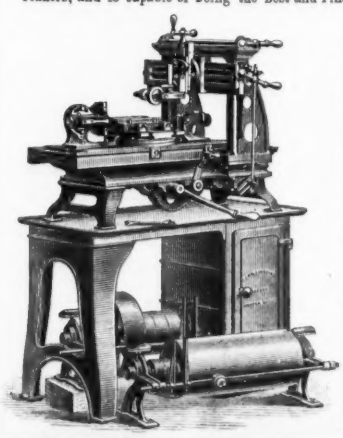

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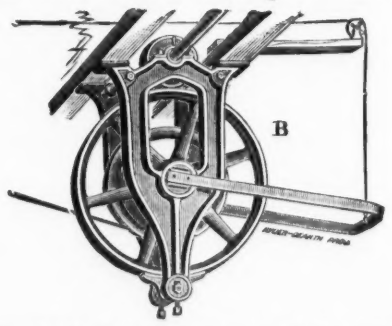

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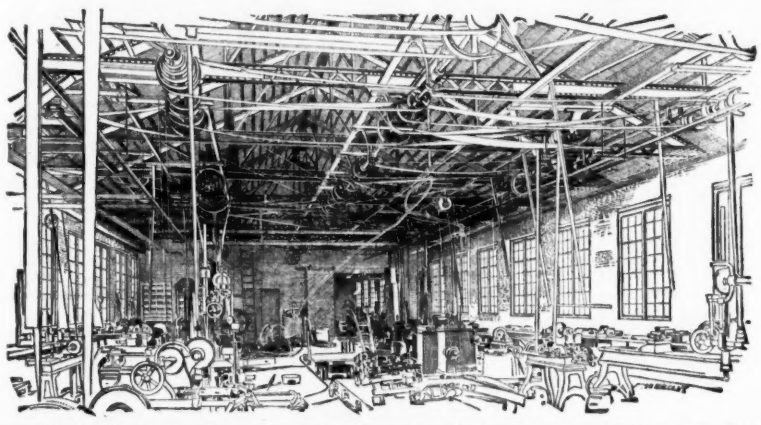

The above illustration is taken direct from a photograph, and shows the construction of an Iron Truss Roof designed and built by us for the C. W. Hunt Co., at West New Brighton, Staten Island, N. Y. The building is 42 feet in width by 202 feet in length, and is used by the C. W. Hunt Co. as a Machine Shop. The side walls are of brick and the roof trusses of iron with iron purlins covered with slate, so that no woodwork is used about the construction of the building in any way, shape or manner, thus eliminating entirely the danger from fire. This is one of the best designed and equipped Machine Shops of its size in the United States.

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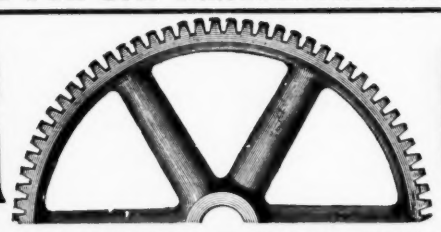

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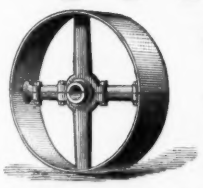

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11	1 3-4	1.10
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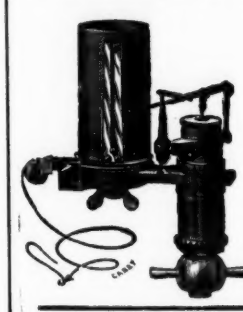

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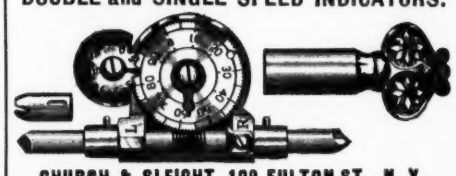

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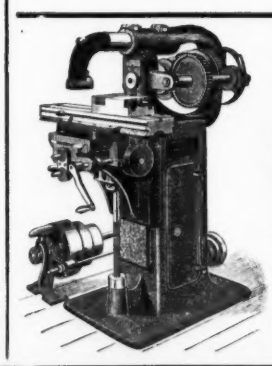

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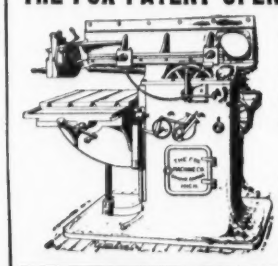

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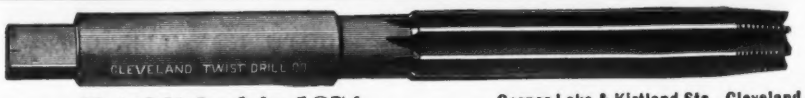

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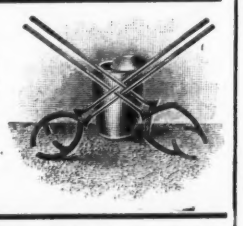

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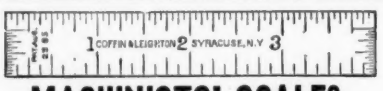

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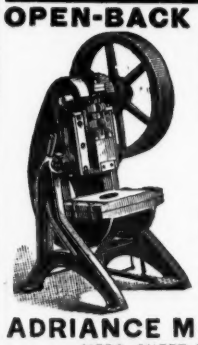

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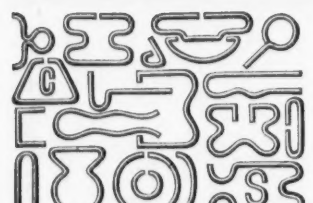

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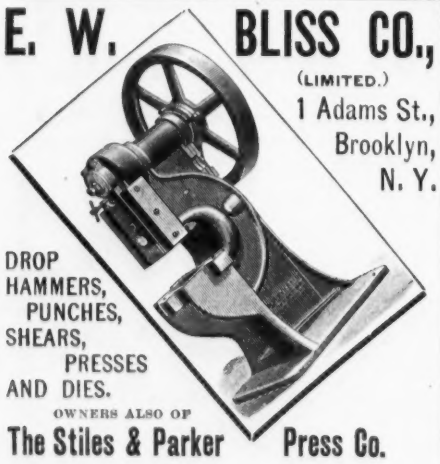

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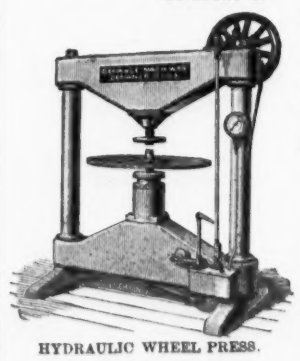

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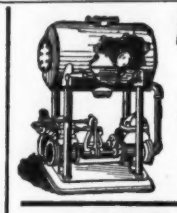

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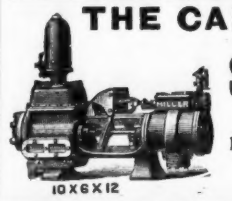

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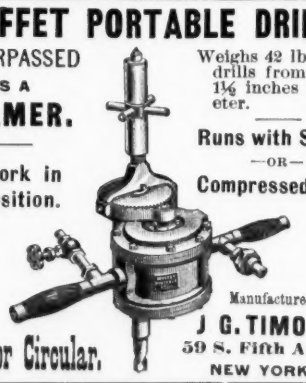

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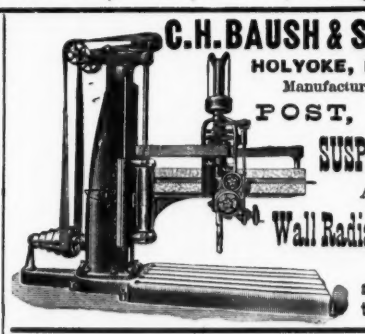

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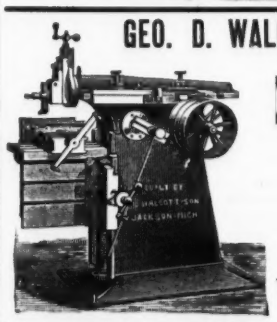

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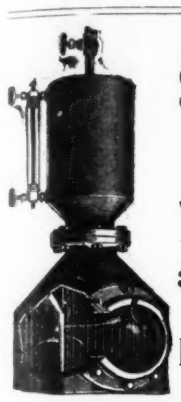

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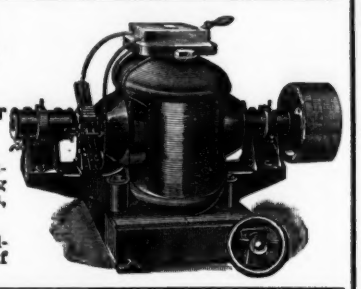

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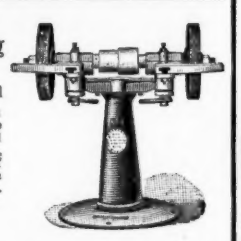

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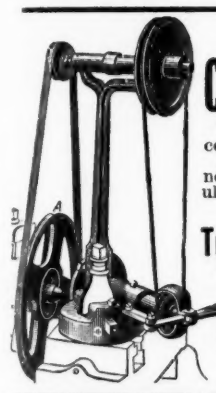

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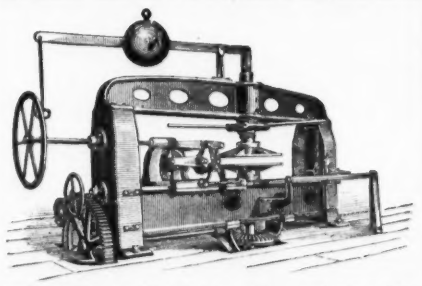

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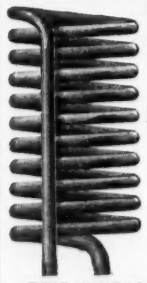

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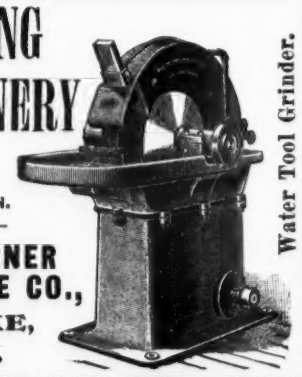

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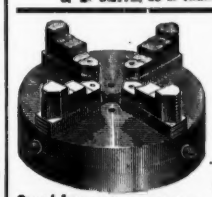

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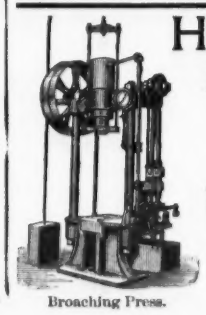

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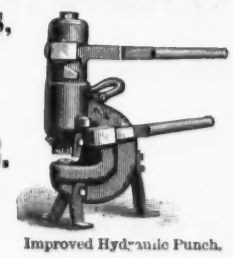

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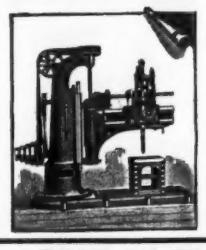

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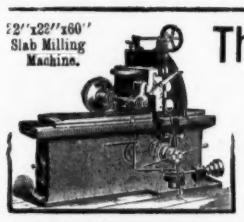
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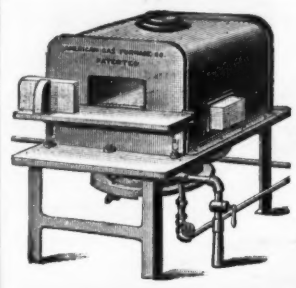

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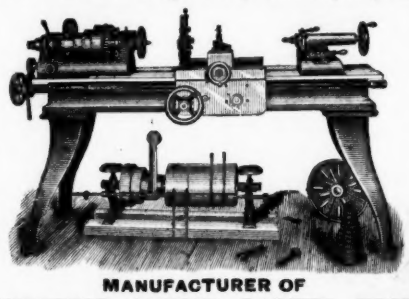

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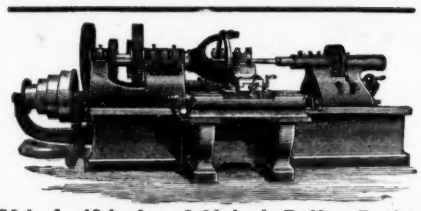

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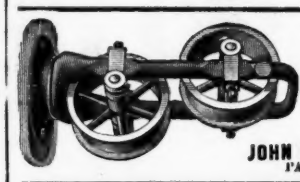

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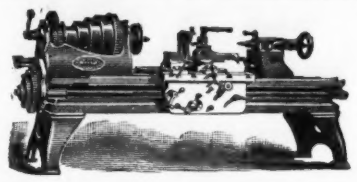

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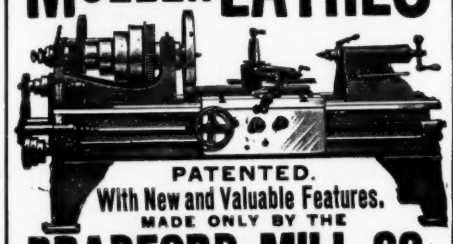

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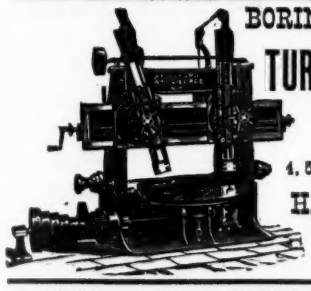

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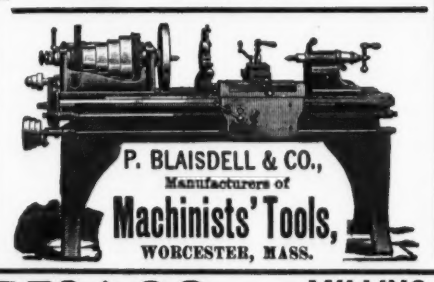

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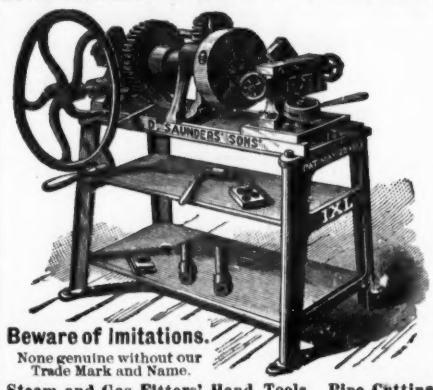

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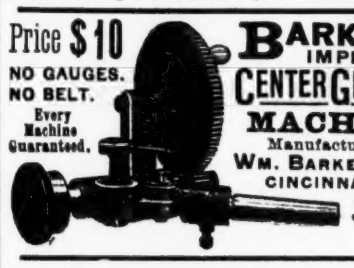

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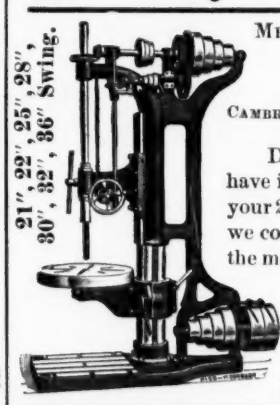

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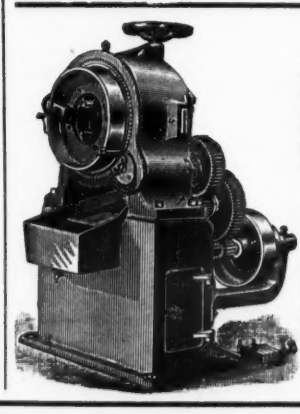

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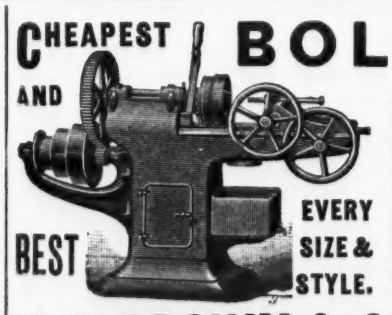

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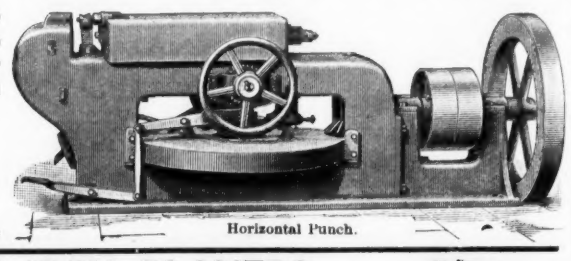
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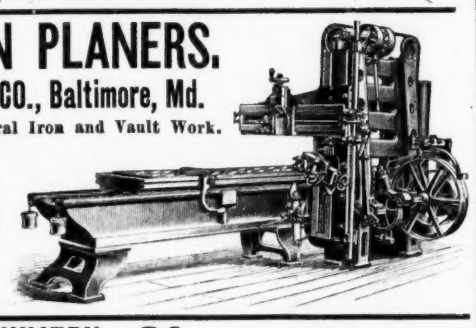
THE VAN DORN IRON WORKS CO., Structural Iron and Vault Work.
CLEVELAND, OHIO, Dec. 7, 1891.
GENTLEMEN: In regard to the planer you furnished us something over a year ago, would state that it is doing our work admirably, we being able to do work of almost any capacity on same to good advantage. We recently coped 15 inch beams 20 feet long advantageously under the tool. Our factory could not get along without it. Very truly yours,
THE VAN DORN IRON WORKS CO.
J. H. VAN DORN.



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CLEVELAND, OHIO.
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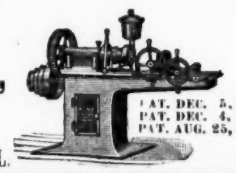
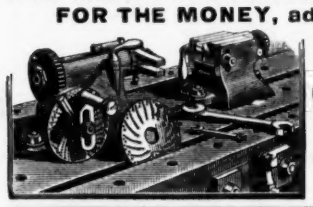
ACME BOLT & RIVET HEADERS,
Acme Single & Double Automatic BOLT CUTTERS.
Cutting from 1-8 in. to 6 in. diameter.
Also SEPARATE HEADS and DIES.
FIRST PREMIUM, CINCINNATI CENTENNIAL.


PAT. DEC. 5, 1882.
PAT. DEC. 4, 1883.
PAT. AUG. 25, 1885.

FOR THE BEST PLANER CENTER FOR THE MONEY, address,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WITH GROUND AND GRADUATED VIAL.
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An Indispensable Tool for all Bench Woodworkers. Latest and Best Design. Infringers Prosecuted. Trial, not orders, solicited.
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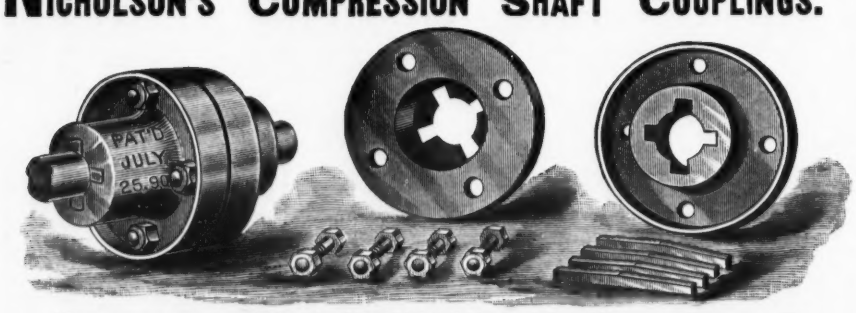

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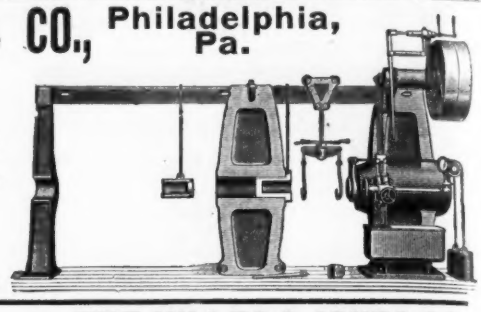

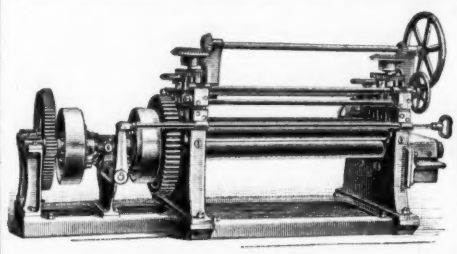
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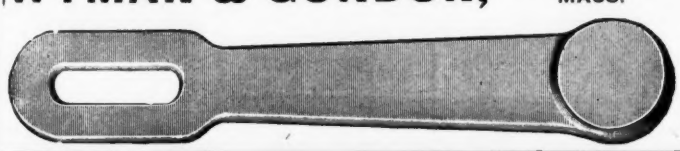

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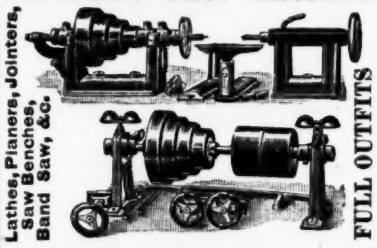
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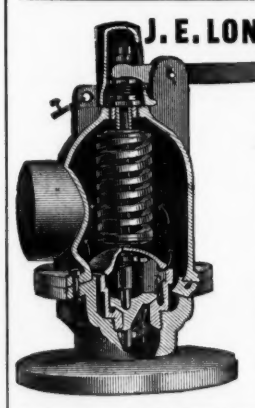

THE ERIE KEY-SEATING MACHINE.
MANUFACTURED BY
THE BURTON MACHINE CO.,
302 Peach St., Erie, Pa., U. S. A.
ARMINGTON & SIMS ENGINE COMPANY,
PROVIDENCE, R. I., August 28, 1891.
The Burton Machine Co., Erie, Pa.
GENTLEMEN: — Answering your favor of the 26th inst. inquiring how we like the Erie Key-seating Machine, would say that, after having it in operation several months, it gives good satisfaction, and cuts a key very quickly and accurately.
Very truly yours,
ARMINGTON & SIMS ENGINE CO.
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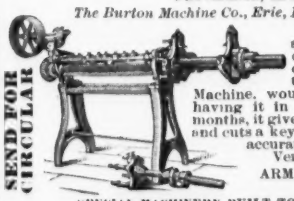
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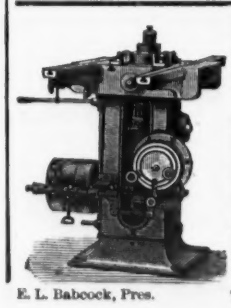
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Gentlemen: The large KEY SEATER which we bought of you has now been in operation for a number of months, and we have been using it almost constantly since it was purchased, and we are very much pleased with it indeed. We also have a machine made by another firm, which we thought was a good machine, but now that we have both in our factory, and use them both, we like yours very much the best.
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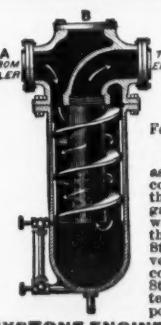

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For Supplying Clean and Dry Steam to Engines, Dry Houses, etc.
Place Separator as close to engine as possible, the steam taking a spiral course between the threads causes the water to be thrown by centrifugal force against the outer walls, while the dry steam goes through the small holes to center of pipe. Steam can enter at A or B, as convenience may require; also used in conveying steam long distances, for Steam Hammers, Dry Houses, Water Gas Generators, and for all purposes where Dry Steam is necessary.
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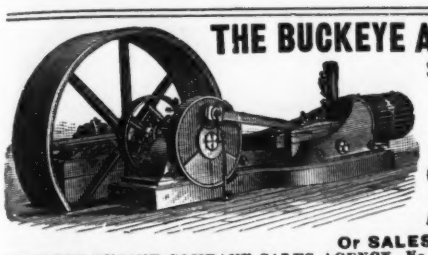

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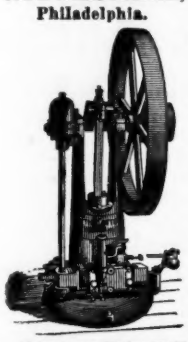

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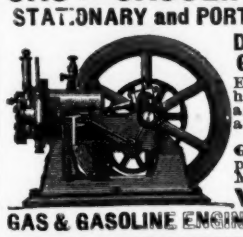

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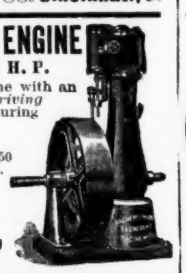

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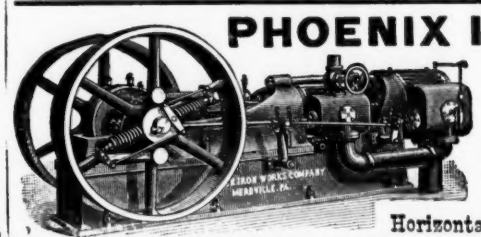

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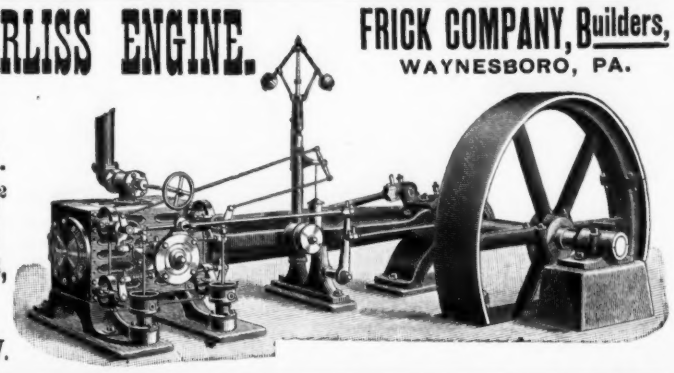

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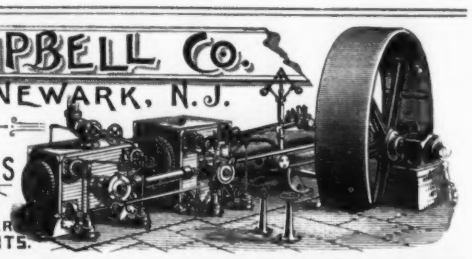

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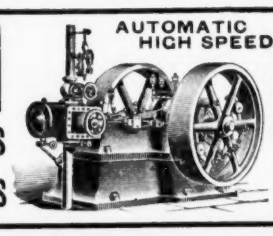

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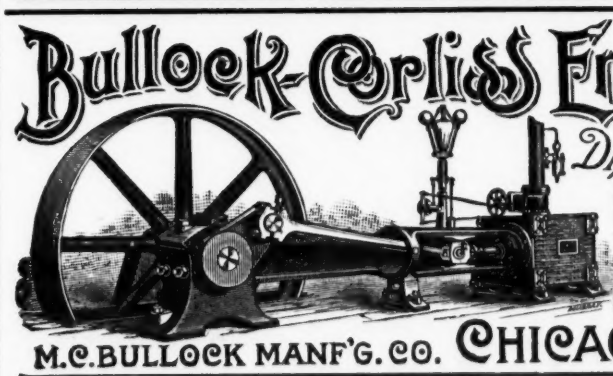

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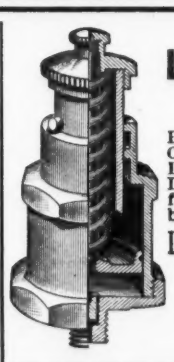

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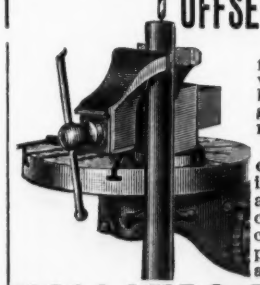

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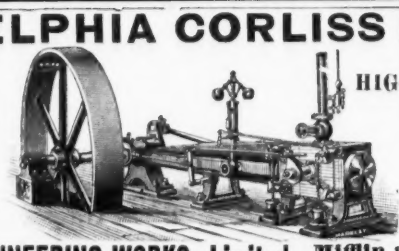

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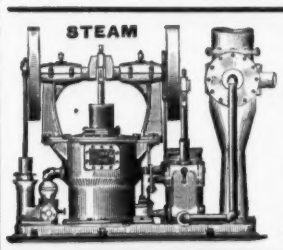
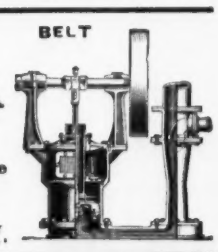
STEAM



BELT



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HANDSOME CATALOGUE FREE.

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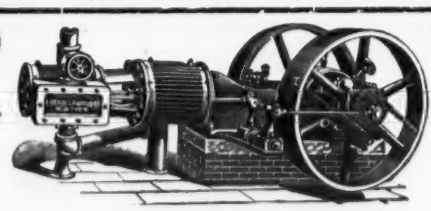

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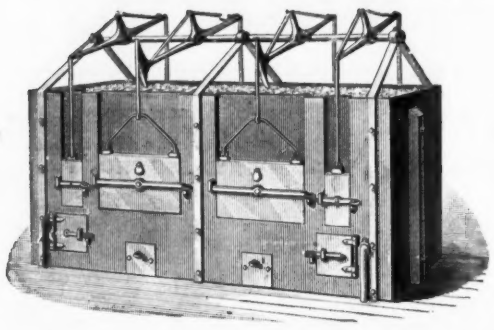

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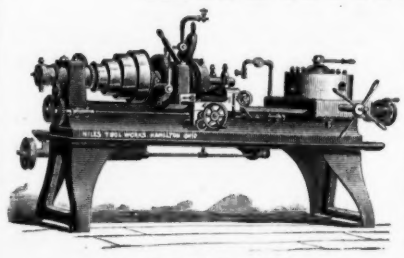

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☞ **Printed Copies of this reward furnished for posting in shops.**

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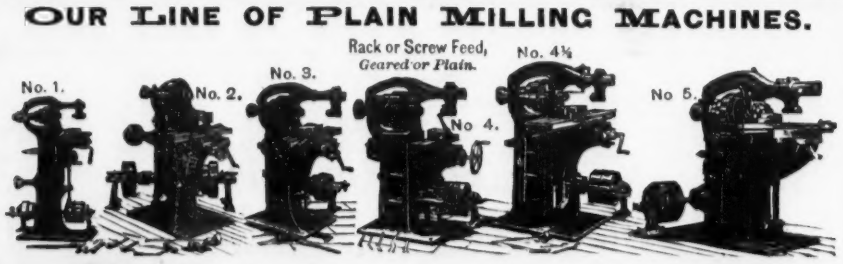

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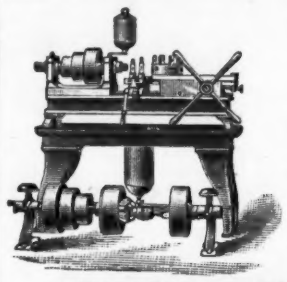

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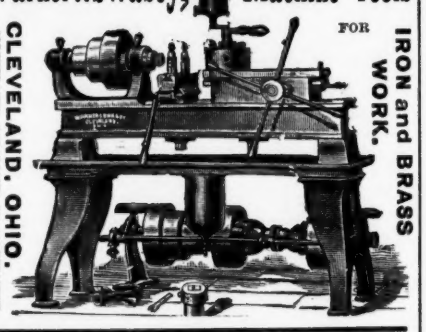

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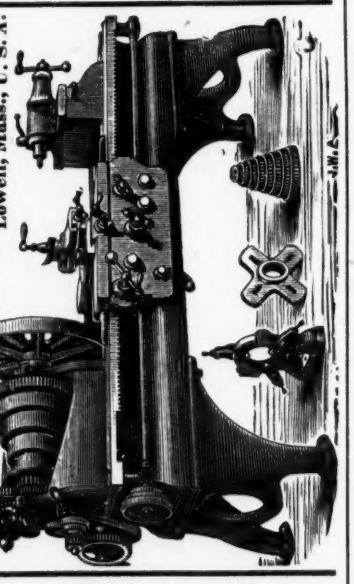

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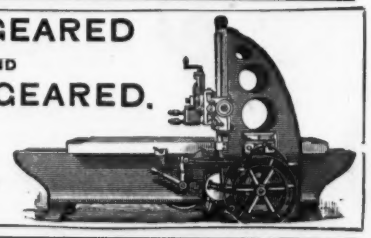
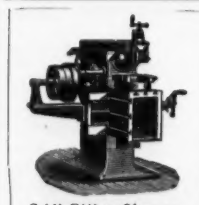
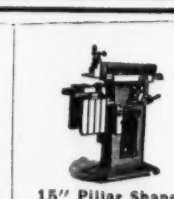




24″ Pillar Shaper.



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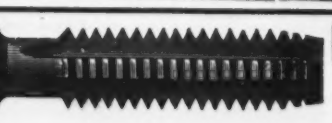

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